DOE/CF-0177

Department of Energy

FY 2022 Congressional Budget Request

Budget in Brief

May 2021 Office of Chief Financial Officer

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ADVANCING CLEAN ENERGY INNOVATION, TACKLING THE CLIMATE CRISIS, ENSURING THE NATION'S NUCLEAR SECURITY AND SUSTAINING INVESTMENT IN ENVIRONMENTAL CLEAN-UP

The mission of the Department of Energy (DOE) is to support the Nation's prosperity by addressing its energy, environmental, and nuclear security challenges through transformative science and technological solutions. DOE's Fiscal Year (FY) 2022 Budget Request (Request) of $46.2 billion is strengthened by the President's American Jobs Plan creating jobs through deployment of clean energy projects; bringing America to the forefront of clean energy innovation; tackling the climate crisis with the urgency science demands; investing in communities that have been left behind; ensuring the Nation's nuclear security; and sustaining the Nation's investment in cleanup of World War II and Cold War nuclear sites.

The FY 2022 Budget Request is another important opportunity for the Biden Administration to continue laying a stronger foundation for the future of the Nation and to reverse a legacy of chronic under-investment in crucial priorities. This Request is a means for America not only going back to the way things were before the COVID-19 pandemic and economic downturn struck, but is a path to begin building a better, stronger, more secure and more inclusive America. The FY 2022 Budget Request will continue to advance our core science and security missions and will jump-start efforts to create jobs and build the clean energy economy of the future. The Request supports an economy that better suits American families and an economy that works for all types of communities with jobs for all kinds of workers. America is back at the table for climate action and the Request supports new funding opportunities for technologies ranging from carbon capture to geothermal energy to extracting critical minerals from coal waste. Ambitious new goals for renewable energy are set to cut solar costs by more than half and add 30 gigawatts of offshore wind capacity by 2030.

The U.S. must deploy research and development (R&D) initiatives developed at the National Laboratories. The National Laboratories have served as the Nation's leading institutions for scientific innovation for more than 75 years, and most recently, these National Laboratories continued working toward groundbreaking discoveries, including in the fight against COVID-19. These investments are a down payment on what we need to do as a Nation. To build an economy that positions American families and American communities to thrive, we need the investments of the American Jobs Plan and the FY 2022 Budget Request to take us further.

The FY 2022 Budget Request supports the President's vision of achieving carbon pollution-free electricity by 2035 while creating good-paying jobs by investing over $2.2 billion in a Building Clean Energy Projects and Workforce Initiative at DOE. This investment will support efficient implementation of American Jobs Plan programs – including programmatic infrastructure for a new energy efficiency and clean electricity standard --weatherizing 50,000 low-income homes, increasing the efficiency of federal buildings through performance contracts, and establishing a new Build Back Better Challenge Grant competition to support novel State-, local-, and Tribal-level approaches to clean energy deployment that provides benefits to marginalized and overburdened communities and streamlined transmission investment. These investments will develop and deploy technologies that will deliver a clean energy revolution resulting in affordable, abundant clean power delivered on a modern energy grid that is resilient and reliable.

DOE is committed to securing environmental justice and spurring economic opportunity for disadvantaged communities that have been historically marginalized and overburdened by pollution and experience underinvestment in essential services. In line with Executive Order 14008, DOE will take proactive actions to work towards ensuring 40 percent of the benefits of climate and clean energy, remediation of legacy pollution, and workforce development investments are directed to disadvantaged communities. These actions will include an examination of the activities of key programs to determine whether those programs' benefits have accrued to disadvantaged communities. DOE will also begin to track program expenditures that impact disadvantaged communities and consider metrics that will help track how applicable covered program benefits accrue at specific disadvantaged communities.

Within DOE, the FY 2022 Budget Request invests more than $8 billion in clean energy and climate innovation. From investing in advanced nuclear reactors, electric vehicles, and green hydrogen, to funding innovative approaches to air conditioning and refrigeration, the requested funding puts the Nation on a path to quadruple clean energy research in four years, emphasizing U.S. pre-eminence in innovating the technologies needed to tackle the climate crisis. These investments will leverage the tremendous innovation capacity of our 17 National Laboratories, American universities, and entrepreneurs to transform our power, transportation, buildings, and industrial sectors to clean, emissions-free power sources and help achieve a net-zero emissions economy by 2050. The FY 2022 Budget Request advances us towards these goals by building on basic science breakthroughs at our

National Laboratories; employing the resources that turn those science breakthroughs into deployable technologies like those supported by the Advanced Research Projects Agency-Energy (ARPA-E); and the creation of the Advanced Research Projects Agency-Climate (ARPA-C) to develop technologies to address climate adaptation, resilience and non-energy emissions mitigation. Meanwhile, the Department's applied energy programs, which run the gamut from renewables to efficiency, carbon capture to hydrogen, and grid technology to storage are going to make it their mission to bring clean energy solutions to life.

The FY 2022 Budget Request supports increased funding for a revitalized Office of Fossil Energy and Carbon Management (FECM) that will advance carbon reduction and mitigation in sectors and applications that are difficult to decarbonize, including the industrial sector, with technologies and methods such as carbon capture and storage, hydrogen, and direct air capture – all while ensuring the reduction in pollution and cumulative impact to overburdened communities . The Request will also fund DOE's role in supporting the newly established Interagency Working Group on Coal and Power Plan Communities and Economic Revitalization.

In FY 2022, the Department will drive new initiatives to achieve energy equity and environmental justice across the DOE complex and labs; ensure the overall benefits of DOE investments in specific areas are targeted to help disadvantaged communities (Justice40 Initiative); help to create climate and clean energy jobs and accelerate clean energy business creation in historically marginalized and overburdened communities that have been systemically denied a full opportunity to participate in America's prosperity. In addition, DOE is spearheading the energy justice initiative, which will be the driver for Administration priorities regarding Executive Order 14008, Tackling the Climate Crisis at Home and Abroad.

Of note, the FY 2022 Budget Request helps DOE build the energy economy back better in a way that supports communities left behind for far too long. The Request supports fossil fuel workers translating their skills to new positions in various areas, from building carbon capture and hydrogen systems on existing industrial and power plant facilities to building zero-emission buses and upgrading the electric grid to exploring for geothermal energy and reinforcing existing pipelines to minimize methane emissions. DOE will also support communities of color living with the toxic legacy of air pollution, those who are still paying too much for their energy, and who are often the first and worst impacted by the climate emergency. By supporting the POWER+ Initiative, and complementing other targeted investments across the Federal Government, DOE will help communities impacted by the energy transition and ensure their success. Their predecessors built the U.S. economy of the 20th Century; they will power the economy of the 21st Century.

The FY 2022 Budget Request invests $7.4 billion, an increase of more than $400 million over the FY 2021 Enacted level, in the Office of Science (SC) to better understand our changing climate, identify and develop novel materials and concepts for clean energy technologies of the future, advance artificial intelligence and quantum science as well as the world's most advanced computing to enhance prediction and decision-making across numerous environmental and scientific challenges, and of course to support the national research community with cutting-edge scientific facilities. This investment in foundational research will support America's first-rate scientists, engineers, and entrepreneurs, who develop and deploy technologies that improve our lives and jumpstart new industries.

The FY 2022 Budget Request creates and enhances research funding opportunities and invests in infrastructure such as laboratory facilities for Historically Black Colleges and Universities (HBCUs) and other Minority-Serving Institutions (MSIs). It also increases resources for workforce development programs to augment pathways to good-paying Science, Technology, Engineering, and Math (STEM) careers for students attending these schools. Planning begins for a new National Laboratory or Center focused on climate, that will expand research capacity, and create new opportunities at HBCUs and other MSIs. The Request will build on the DOE's existing relationships with HBCUs and MSIs, establish new partnerships with these institutions, and include them in our efforts to target disadvantaged communities for new clean energy investments, jobs, and businesses, while doubling down on our commitments to racial justice.

The President's FY 2022 Budget Request is $19.7B for the National Nuclear Security Administration (NNSA) and $7.6B for Environmental Management (EM). The Request supports a safe, secure, and effective nuclear stockpile and a continued modernization program. This includes the recapitalization of the NNSA's physical infrastructure and essential facilities. The Request also funds key nuclear nonproliferation and counterterrorism programs and increases funding for the Naval Nuclear Propulsion Program, which designs, builds, operates, maintains, and manages the reactor systems of the Naval nuclear fleet, and increases the number of highly skilled staff to carry out the mission. Additionally, the Request sustains our investment in the EM mission to clean up World War II and Cold War nuclear sites.

The FY 2022 Budget Request proposes to invest $642 million in cybersecurity activities, an increase of $189 million, or 42%, over the FY 2021 Enacted level. This will enable the Department to make significant contributions toward modernizing cybersecurity defenses by protecting federal networks and strengthening the United States' ability to respond to incidents when they occur. The Department will be guided by the key areas, as identified in Executive Order (EO) 14028, which are to; remove barriers to threat information sharing between government and the private sector; modernize and implement stronger cybersecurity standards; improve software supply chain security; improve investigative and remediation capabilities; and improve cybersecurity threat hunting and response through improved logging and data analytics. Of the $189 million increase for cybersecurity efforts, $93 million is dedicated to a cyber reserve fund, managed by the Office of the Chief Information Officer for the DOE enterprise, to address cyber incident, recovery, and response management at the Department.

OVERVIEW

The President's Budget for FY 2022 requests $46.2B for the Department of Energy to meet today's and tomorrow's challenges by advancing clean energy innovation, tackling the climate crisis, ensuring the safety and security of the Nation's nuclear stockpile and sustaining investment in environmental clean-up. The Request highlights new crosscutting activities and research, development, demonstration, and deployment of novel technologies. The President's FY 2022 Budget Request maintains global leadership in scientific and technological innovation in part through DOE's 17 National Laboratories. DOE remains committed to placing the Nation on a path to quadruple clean energy research Government-wide in four years, emphasizing U.S. preeminence in developing innovative technologies needed to tackle the climate crisis as well as sustaining the Nation's investment in cleanup of World War II and Cold War nuclear sites. The Request also supports a safe, secure, and effective nuclear stockpile and a continued modernization program that includes the recapitalization of physical infrastructure and essential facilities.

The FY 2022 Budget Request provides:

- $8.0B for applied energy technologies that will make the Nation's energy supply more affordable, reliable, and efficient promoting energy independence and dominance.

- $7.4B to progress cutting-edge scientific R&D, including support for Industries of the Future, such as quantum information science (QIS) and Artificial Intelligence (AI). The Request funds key technologies such as microelectronics, advanced manufacturing, biotechnology, and technology transfer. The Request alsosupports state-of-the art scientific tools and facilities keeping U.S. researchers at the forefront of scientific innovation.

DEPARTMENT OF ENERGY
FY 2022

DOE	**$M**
• Applied Energy Programs	8,008
• Office of Science	7,440
• Innovation Offices	1,100
• National Security	27,755
• Other Programs, Administration and Oversight	2,503
• Receipts	*-20*
DOE Total	**46,192**

- $1.1B for innovation offices that support transformative solutions for carbon-pollution free electricity, adaptation and resilience against the climate crisis and lay the foundation for future improvements in research and development across multiple agencies. In addition, funding is requested for an initial competitive solicitation on commercial-scale energy storage demonstrations that will leverage existing technical expertise throughout the applied programs.

- $27.8B to support national security, including environmental cleanup:

    - $7.6B to continue cleanup of sites resulting from six decades of nuclear weapons development and production and Government-sponsored nuclear energy research.

    - $19.7B to sustain and modernize the U.S. nuclear stockpile and aging infrastructure, reduce global nuclear threats, and propel the nuclear Navy.

- $2.5B for other programs not identified above as well as Departmental Administration, Other Defense Activities, and oversight activities. These programs include $1.2B for Other Defense Activities for Environment, Health, Safety and Security, Enterprise Assessments, Specialized Security Activities, Hearings and Appeals, and Defense Related

Administrative Support (DRAS). For the Office of Technology Transitions a separate appropriation of $19M is requested as well as $429M for the Office of Legacy Management (LM) which includes $250M to support a proposal to consolidate administration of the Formerly Utilized Sites Remedial Action Program under the Department of Energy. A total of $127M is requested for the Energy Information Administration, $122M for the Office of Indian Energy Policy and Programs, and $80M for the four Power Marketing Administrations. Finally, the FY 2022 Budget Request includes $400M for Administration and Oversight activities, including Departmental Administration (DA), the Office of the Inspector General, and offsets.

In FY 2022, the Request will support continued development of two SC-supported exascale systems. The first of these two exascale systems will be deployed calendar year 2021 at Argonne National Laboratory, with the second coming on-line in the 2022–2023 timeline at Oak Ridge National Laboratory. In addition, the FY 2022 Budget Request will provide support for the procurement of and site preparation for a third exascale system delivered to NNSA at Lawrence Livermore National Laboratory in FY 2023. The SC and NNSA partnership will bolster America's national security by strengthening the nuclear stockpile and next generation of science breakthroughs not possible with today's fastest computing systems.

APPLIED ENERGY PROGRAMS

The FY 2022 Budget Request provides $8.226B for the applied energy and related programs and funds research and development while focusing on the Administration's support of later-stage development, demonstration, and deployment to address unique challenges to rapid scale-up and commercialization. DOE is committed to supporting energy initiatives that will attract investments, safeguard the environment, and strengthen energy security. Given the nexus between a growing clean energy economy and the potential for job creation, the FY 2022 Budget Request elevates the Department's role in enabling the commercialization and deployment of clean energy technologies. Deployment efforts across the agency will leverage DOE expertise and resources to accelerate adoption of existing and new energy technologies that can reduce, avoid, or sequester greenhouse gas (GHG) emissions while ensuring the development and expansion of the Nation's clean energy workforce.

APPLIED ENERGY
FY 2022

Applied Energy Programs	**$M**
• Energy Efficiency and Renewable Energy	4,732
• Cybersecurity, Energy Security, and Emergency Response	201
• Office of Petroleum Reserves	218
• Electricity	327
• Nuclear Energy	1,858
• Fossil Energy Carbon Management	890
Applied Energy Total	**8,226**

Highlights include:

- $4.732B for the Office of Energy Efficiency and Renewable Energy (EERE) to achieve a carbon-pollution free electricity sector by 2035 and net-zero emissions, economy-wide, by no later than 2050 through investments in five programmatic priority areas, through the lens of four key emphasis areas. The Request prioritizes increased investments to reduce emissions in the near term drastically, while investing in research to ensure American leadership and competitiveness in advanced clean energy technology. In FY 2022, EERE will also continue to streamline and enhance its operations, conduct rigorous analysis and evaluations of its portfolio, and achieve the greatest possible impact in each of its technical pillars designed to advance cross-technology solutions, and a Corporate Program pillar that serves as the central organization for all EERE products, services, processes, and systems. To achieve this mission, EERE invests in the integration of clean energy technologies that are ready to be demonstrated and deployed, as well as R&D activities that advance early-stage technologies with a clear path to deployment. EERE's FY 2022 investment strategy focuses on the follow five programmatic priority areas that are central pillars to reducing the GHG profile:

    - Decarbonizing the electricity sector: To transition to a carbon-free electricity sector, invest in activities critical to reduce the cost of renewables, as well as to make major strides in renewables integration to ensure reliability, security, and resiliency as the grid evolves.

    - Decarbonizing transportation across all modes: To develop and enable the commercial deployment of net-zero GHG technologies for all modes of transportation (road, rail, sea, and air) while ensuring affordable mobility solutions for

people and goods across all economic and social groups, reducing the impact on local air quality and using sustainable water and land practices.

- Decarbonizing the industrial sector: To support approaches that rely on renewable energy and fuels such as hydrogen to power industrial processes, capture and use carbon emissions, and vastly improve efficiency.

- Reducing the carbon footprint of buildings: To support critical deployment activities needed to transform the energy economy at the state and local levels as well as investments in high priority research, development, and demonstration (RD&D) needed for new affordable housing and advanced energy efficient retrofits for buildings.

- Decarbonizing agriculture**:** To expand EERE's work related to reducing GHG emissions in the agricultural sector through the development of biofuels, the greater efficiency of off-road agricultural vehicles, on-site production of animal waste to clean energy, and better understanding and predicting water flow to design more water and energy efficient irrigation systems.

- $201M for the Office of Cybersecurity, Energy Security, and Emergency Response (CESER), which leads the Department's efforts to secure U.S. energy infrastructure against all hazards, reduce the risks of and impacts from cyber events and other disruptive events, and assist with restoration activities. Due to the critical role the energy sector plays across Federal, State, and local jurisdictions, CESER programs work in an integrated manner in partnership with industry and other stakeholders, as well as other DOE offices and other Federal agencies, to enhance the resilience and security of the U.S. energy infrastructure for all consumers, in line with energy justice principles. The Budget supports the development of risk management tools to strengthen the energy sector against cyber threats, information sharing and partnerships, and response and restoration activities. The FY 2022 Budget Request includes a minor restructuring of CESER's existing programs and proposes that the Office of Petroleum Reserves will soon be shifted to report to the Assistant Secretary for CESER; no change in appropriations request is needed for this move.

- $218M for the Office of Petroleum Reserves, which the Budget proposes to have report to the Assistant Secretary for CESER, with $197M for the Strategic Petroleum Reserve (SPR). The SPR provides strategic and economic security against potential interruptions in U.S. petroleum supplies. The FY 2022 Budget Request supports the programs operational readiness and drawdown capabilities.

- $327M for the Office of Electricity (OE) to lead the Department's efforts to strengthen, transform, and improve energy infrastructure so consumers have equitable access to resilient, secure, and clean sources of electricity. OE provides solutions to market, institutional, and operational failures that go beyond any one utility's ability to solve. To accomplish this critical mission, OE works with private industry and Federal, State, Tribal, and territorial governments on a variety of initiatives to modernize the electric grid. OE programs work in an integrated manner in partnership with industry and other stakeholders, as well as other DOE offices, to enhance key characteristics of the U.S. electric transmission and distribution systems. With the funds requested OE will pursue research for technologies to improve grid reliability, resilience, efficiency, flexibility, and functionality; develop new and advanced utility-scale storage technologies; design next generation systems that are built from inception to automatically detect, reject, and withstand cyber incidents; develop core analytic, assessment, and engineering capabilities; national-scale sensor, data, and communication architecture platforms; and construction of the Grid Storage Launchpad.

- $1.851B for the Office of Nuclear Energy (NE) to extend the impact of Research, Development, Demonstration & Deployment (RDD&D) funding by leveraging funding mechanisms - such as competitions, technical assistance, and programs targeted to small businesses. The Request enables the commercialization of climate change and clean energy innovations that will activate clean energy innovation creating good paying jobs that provide the free and fair choice to join a union, expand other public impact outcomes such as combating climate change, and yield a more geographically diverse, environmentally just and impactful research portfolio . NE focuses on three major mission areas: the nation's existing nuclear fleet, the development of advanced nuclear reactor concepts, and fuel cycle technologies. Investments in these areas leverage the tremendous innovation capacity of the United States' National Laboratories, universities, and advanced reactor developers to transform America's power sector. NE is also responsible for ensuring the operational and securing the availability of the Idaho National Laboratory as a national asset supporting a broad range of civilian and national security research. A total of $38M is included for management and technical costs necessary to carry out the Integrated Waste Management System subprogram.

- $7.5M from the Nuclear Waste Fund (NWF) to fund the Department's responsibilities for managing the NWF itself, administering the Standard Contract, and maintaining the security of the Yucca Mountain site.

- $890M for the Fossil Energy and Carbon Management Research and Development (R&D) program conducts research that focuses on early-stage technologies that help to ensure clean and affordable energy for all Americans, facilitate the transition towards a carbon-pollution-free economy, rebuild a U.S critical minerals (CM) supply chain, and retain and create good paying jobs with a free and fair chance to join a union and collectively bargain. To meet these challenges, the Budget re-focuses funding from traditional fossil combustion-centric activities (e.g. Advanced Energy Systems and Cross-cutting Research) to climate-centric activities (e.g. Carbon Capture, Utilization, and Storage). These reallocations will enable near-term work to develop and deploy carbon solutions for the power and industrial sectors. Immediate action will be taken to locate and mitigate methane leaks, one of the most potent greenhouse gases – coupled with longer term R&D to expedite the hydrogen (H2) energy economy. These investments will be critical to meet 100% clean electricity by 2035. Carbon dioxide removal will be an important tool to achieve net-zero emissions economy-wide by 2050. The Office of Fossil Energy and Carbon Management (FECM) is investing in direct air capture, carbon capture and storage coupled to the conversion of biomass waste to energy, and accelerated weathering through mineral carbonation to assist in meeting our climate goals. The FY 2022 Budget Request for FECM will extend the impact of DOE's RDD&D funding by leveraging creative funding mechanisms - such as prizes, competitions, technical assistance, and programs targeted to small businesses. The goal is to enable the commercialization of climate change and clean energy innovations that will activate job creation, expand other public impact outcomes, and yield a more geographically diverse and impactful research portfolio. The FY 2022 Budget Request also includes funding for the investments at the National Energy Technology Laboratory (NETL), and the basic operating costs of FECM. FECM's FY 2022 RDD&D priorities include: reducing methane emissions, accelerating zero-carbon and carbon-neutral hydrogen, developing low-carbon supply chains for industries, advancing carbon dioxide removal from the atmosphere, investing in thoughtful transition strategies, demonstrating, and deploying point source carbon capture and storage, advancing critical minerals, and increasing efficient use of big data and artificial intelligence.

- Energy Earthshots Initiative**:** Crosscutting initiatives designed to achieve the clean energy breakthroughs that will transform U.S. energy sectors and create the jobs of the new energy economy. The Energy Earthshots Initiative will drive integrated program development across DOE's science and applied energy offices and ARPA-E to advance carbon-neutral fuels such as hydrogen, modernize grid infrastructure including storage, and revolutionize carbon management. Energy Earthshots take an 'all R&D community' approach to leading science and technology innovations that will decarbonize major sectors of the economy at scale to build the infrastructure of the future in heavy industry, transportation, buildings, and other areas.

PROGRESSING SCIENTIFIC RESEARCH

The FY 2022 Budget Request includes $7.4B to increase investments in Administration priorities including basic research on climate change and clean energy, fundamental science to transform manufacturing, biopreparedness, and participation and retention of underrepresented groups in research activities. The Request also supports ongoing investments in priority areas including microelectronics, critical materials, quantum information science (QIS), artificial intelligence (AI) and machine learning (ML), exascale computing, integrated computational and data infrastructure for scientific discovery, and accelerator science and technology.

The Request funds the Office of Science at $7.4B providing $445M for exascale computing initiative to help secure a global leadership role in exascale, $301M for QIS, $129M for AI and ML, and $30.2M to enhance materials and chemistry foundational research to support U.S.-based leadership in microelectronics. SC efforts in QIS, including development of quantum computing and quantum sensor technology, and AI/ML, will benefit national security, economic competitiveness, and secure America's continued leadership in science.

Highlights include:

- $1.0B for Advanced Scientific Computing Research (ASCR) to advance science and U.S. competitiveness through investments in computational research, applied mathematics, and computer science, as well as development and operation of multiple, large, high performance and leadership computing user facilities and high-performance networking. To meet SC's high performance computing mission for the exascale project, the Request funds research and development activities and full scale runs to deliver project performance targets on the Nation's first exascale system, Frontier, which is projected to achieve exascale-capable systems with a five-fold improvement in true application performance over the Summit system at the Oak Ridge

Leadership Computing Facility. The Request increases support for ASCR's Computational Partnerships with a focus on developing partnerships in quantum computing and data intensive applications, and new partnerships that broaden the impact of both exascale and data infrastructure investments in areas of importance to DOE. A new SC-wide activity, Reaching a New Energy Sciences Workforce (RENEW), targets efforts to increase participation and retention of underrepresented groups in SC research activities. The Request will support partnerships with Basic Energy Sciences, Fusion Energy Sciences, High Energy Physics, and Nuclear Physic in RENEW, microelectronics, and new data and partnerships with the National Institutes of Health (NIH), as well as engagements with other agencies to improve our ability to assist in times of national emergencies.

- $2.3B for Basic Energy Sciences (BES) to support fundamental research to understand, predict, and ultimately control matter and energy at the electronic, atomic, and molecular levels to provide the foundations for new energy technologies, to mitigate the environmental impacts of energy use, and to support DOE missions in energy, environment, and national security. Core BES research activities support Administration priorities on clean energy (carbon capture, hydrogen, solar, etc.); related topics such as critical materials and transformative manufacturing (including polymer upcycling and next-generation microelectronics); and cross-cutting priorities for national preparedness, quantum information science, data analytics/machine learning and integrated infrastructure for data-driven science, exascale computing, and accelerator science and technology. The Request will continue to fund the Energy Frontier Research Centers, as well as the Batteries and Energy Storage and the Fuels from Sunlight Energy Innovation Hub programs. The Request will continue seven ongoing construction projects and support two major items of equipment projects.

SCIENCE
FY 2022

Office of Science Programs	**$M**
• Advanced Scientific Computing Research	1,040
• Basic Energy Sciences	2,300
• Biological and Environmental Research	828
• Fusion Energy Sciences	675
• High Energy Physics	1,061
• Nuclear Physics	720
• Isotope R&D and Production	90
• Accelerator R&D and Production	24
• Workforce Development for Teachers and Scientists	35
• Science Laboratory Infrastructure	295
• Safeguards and Security	170
• Program Direction	202
Office of Science Program Total	**7,440**

- $828M for Biological and Environmental Research (BER) to support fundamental research to understand complex biological, biogeochemical, and physical principles of natural systems at scales extending from the genome of microbes and plants to the environmental and ecological processes at the scale of the planet Earth. BER's support of basic research will contribute to a future of stable, reliable, and resilient energy sources and infrastructure, that will lead to climate solutions, strengthen economic prosperity and assure environmental justice. The Request funds research in biological systems and integration of biological information into computational models for iterative testing and validation as well as the initiation of new Urban Integrated Field Laboratories and establishment of the National Virtual Climate Laboratory (NVCL) serving as a one stop portal to advance access to climate science from the DOE National Laboratories. Based off previous successes, the NVCL engagement with the science community will focus on Minority Serving Institutions and Historically Black Colleges or Universities (HBCUs) for local to regional climate science. Planning also begins for a new National Climate Laboratory or Center affiliate with an HBCU. Funding requested will be for foundational climate research into actionable solutions for impacted communities and addressing the Administration priorities involving climate solutions and environmental justice and new efforts in advanced manufacturing for novel polymer upcycling approaches. New efforts are supported in Biopreparedness Research Virtual Environment, a distributed framework to rapidly activate, integrate, and coordinate the expertise and research capabilities (experimental and computational) across the whole DOE National Laboratory complex. The FY 2022 Budget Request continues operation of three BER scientific user facilities: the Joint Genome Institute, the Atmospheric Radiation Measurement Research Facility, and the Environmental Molecular Sciences Laboratory.

- $675M for the Office of Fusion Energy Sciences (FES) to support research to understand matter at very high temperatures and densities and to build the scientific foundation needed to develop a fusion energy source. The Request continues to support research and facility operations, including research at international facilities with unique capabilities, research in QIS, and research in high-density laboratory plasma science. Funding for facilities operations includes DIII-D for magnetic fusion and the National Spherical Torus Experiment Upgrade facility repairs, and upgrades at the Matter in Extreme Conditions Petawatt facility project. The Request also funds the U.S. in-kind hardware contribution for the ITER international research project and an ITER Research program to start preparing the U.S. fusion community to take full advantage of ITER Operations after First Plasma.

- $1.1B for High Energy Physics (HEP) for research to understand how the universe works at its most fundamental level, enabling the discovery of the most elementary constituents of matter and energy, the probing of the interactions among them, and the exploration of the basic nature of space and time. The Request provides support to foster a diverse, highly skilled, American workforce, to build R&D capacity, to spur technology innovation, and to conduct world-leading R&D. The Request funds core research activities, including QIS, AI/ML, exascale computing, and multi-disciplinary microelectronics.

- $720M for Nuclear Physics (NP) to support research to discover, explore, and understand all forms of nuclear matter. The Request funds high priority world-class nuclear physics research and core competencies, operations of NP user facilities and continued support for QIS, microelectronics, design activities for the Electron Ion Collider, and fabrication of new NP scientific equipment.

- $90M for Isotope R&D and Production (IRP) ensures robust supply chains of critical radioactive and stable isotopes for the Nation that no domestic entity has the infrastructure or core competency to produce. This new control point splits off funding for isotopes that underpin emerging technology, innovation, and a suite of research and applications that are fundamental to the Nation's prosperity and scientific and technical leadership. The Request funds research activities to support Administration and national priorities on advanced manufacturing; clean energy; transformative technology for producing pure isotopes for QIS; the use of AI/ML for effective operations of transformative approaches to isotope production; the promotion of national preparedness by mitigating single point failures in domestic supply chains; and the strengthening of synergies between the DOE Isotope Program and NIH with the targeted support of translational research to advance clinical trials for cancer and infectious disease.

- $24M for Accelerator R&D and Production supports cross-cutting basic R&D in accelerator science and technology, access to unique SC accelerator R&D infrastructure, workforce development, and public-private partnerships to advance new technologies for use in SC's scientific facilities and in commercial products. The Request funds innovative R&D and deployment of accelerator technology, formation of topically focused multi-institutional collaborations for accelerator R&D, and workforce development as well as public-private partnerships.

- $35M for Workforce Development for Teachers and Scientists to provide for a sustained pipeline of science, technology, engineering, and mathematics workers to meet national goals and objectives, now and in the future. The Request supports the new SC-wide effort, Reaching a New Energy Sciences Workforce, to increase outreach and provide workforce training opportunities at DOE laboratories for underrepresented and under-served groups.

- $295M for Science Laboratories Infrastructure to sustain mission-ready infrastructure and safe and environmentally responsible operations by providing the infrastructure necessary to support leading edge research at ten SC national laboratories and the Science mission, and to assure the new infrastructure provides for the critical needs of the future science initiatives and world class user facilities.

- $170M for Safeguards and Security (S&S) to maintain security measures to protect personnel and assets in an environment of open scientific research. The Request provides additional funding for cybersecurity to address long standing gaps in infrastructure, operations, governance, and compliance to ensure adequate detection, mitigation, and recovery from cyber intrusions and attacks against DOE laboratories and continued security operations at flat levels of effort for all remaining S&S elements.

- $202M for Program Direction to support the skilled and motivated Federal workforce that plans, develops, and oversees SC investments in world-leading basic research and scientific user facilities, and provides critical oversight to ten of DOE's National Laboratories. The Request funds Salaries and Benefits, Travel, Support Services, Other Related Expenses, and Working Capital Fund requirements.

INNOVATION OFFICES

- The FY 2022 Budget Request includes $200M for the establishment of the Advanced Research Projects Agency-Climate (ARPA-C) to identify and promote research with the potential to make revolutionary advances in breakthrough sciences, to translate scientific discoveries and cutting-edge inventions into technological innovations, and to accelerate transformational technological advances in areas that industry by itself will not support because of technical and financial risk and uncertainty. ARPA-C will support these technologies until they are competitive in the market or at a stage that they can be adopted by

government agencies or other organizations that may be the end-users. ARPA-C will invest in climate-related innovations necessary to enable adaptation, increase resilience, and achieve net zero non-energy emissions by 2050. ARPA-C's climate mission complements ARPA-E's (discussed below) advanced energy mission. Appropriations requested here, in addition to the American Jobs Plan, are a down payment on the Administration's broader climate technology agenda that will drive innovation to tackle the climate crisis while creating good paying jobs, assure the U.S. remains the world's leader in climate technologies, and increase societal resilience to climate change impacts. Funding proposed in the Budget will seed the development of ARPA-C, leveraging ARPA-E's innovation model which has proven effective in developing advanced energy technologies and moving them towards deployment. Notwithstanding these gaps, the imperative to address climate-related emissions necessitates that creation of ARPA-C commence expeditiously, including an initial investment to solve the most immediate and pressing problems. To bridge these climate adaptation, resilience and mitigation needs, the Budget also requests $300 million in FY 2022 for the Departments of Agriculture, Commerce, Homeland Security, Housing and Urban Development, Interior, and Transportation, and the Environmental Protection Agency. These interagency ARPA-C partners would coordinate most closely with ARPA-C, making the ARPA-C unique in a mission that spans several agencies rather than ARPA-E or DARPA that primarily serve their Department's. Additional coordination and communication may take place with General Services Administration, National Aeronautics and Space Administration, and National Science Foundation. Any non-DOE agency may request ARPA-C management of designated funds to support programs that meet their mission needs; ARPA-E has managed and selected R&D investments using other agency appropriations in the past to develop promising technologies for Defense applications.

- A total of $500M is included in the FY 2022 Budget Request for the Advanced Research Projects Agency – Energy (ARPA-E) to deliver innovative, investable opportunities to the commercial sector. ARPA-E will continue to deliver value to the U.S. economy with continued emphasis on maintaining a healthy portfolio of projects. These projects cover a broad range of energy topics, with a growing focus on additional scale-up of the most promising projects that have demonstrated success in technical development, project management, and definition of commercial pathways. In FY 2022, ARPA-E plans to release up to fifteen new funding opportunity announcements (FOAs). The FOAs will address new areas not represented in the present portfolio and develop new opportunities opened by the outcomes of previous programs.

- In FY 2022, $400M is being requested to establish the Office of Clean Energy Demonstrations (OCED), to initiate and manage a multi-year series of competitive solicitations. OCED will serve as the Department's hub for accelerating the maturation of near- and mid-term clean energy technologies and systems with the goal of quicker commercial adoption and increased availability. The OCED will accomplish this through a systematic approach that is informed by, and integrated with, existing clean energy innovation initiatives across DOE's diverse program and functional offices, sites and associated National Laboratories. The Request will allow OCED to begin operations and issue at least one initial competitive solicitation on commercial-scale energy storage demonstrations; further scoping may also determine additional project areas. The OCED is envisioned to issue at least one technology neutral commercial-scale demonstration solicitation per year focused on a crosscutting energy challenge.

Environmental Management

The Office of Environmental Management (EM) supports DOE to meet the challenges of the Nation's Manhattan Project and Cold War legacy responsibilities. The FY 2022 Budget Request includes $7.6B for EM to cleanup millions of gallons of liquid radioactive waste, thousands of tons of spent (used) nuclear fuel and nuclear materials, disposition of large volumes of transuranic and mixed/low- level waste, huge quantities of contaminated soil and water, and deactivation and decommissioning of thousands of excess facilities. This environmental cleanup program results from six decades of nuclear weapons development and production and Government-sponsored nuclear energy research. It involves some of the most dangerous materials known to mankind. To date, EM has completed cleanup activities at 92 sites in 30 states and in the Commonwealth of Puerto Rico. EM is currently responsible for cleaning up the remaining 15 sites in 11 states.

ENVIRONMENTAL MANAGEMENT
FY 2022

Environmental Management Sites	**$M**
• Carlsbad/Waste Isolation Plant (WIPP)	437
• Idaho	381
• Oak Ridge	561
• Paducah	275
• Portsmouth	547
• Richland	1,026
• River Protection	1,541
• Savannah River	1,746
• Lawrence Livermore National Laboratory	37
• Los Alamos National Laboratory	334
• Nevada	61
• Sandia Site Office	5
• Separations Process Research Unit	15
• West Valley Demonstration Project	92
• Energy Technology Engineering Center	21
• Moab	85
• Other Sites	16
• Program Direction	293
• D&D Fund Deposit	415
• Mission Support	124
Environmental Management Total (net offset)	**7,596**

Highlights include:

- **Savannah River**
  $978M to support the Liquid Waste Program, to achieve additional risk reduction by stabilization and immobilization of high activity radionuclides through vitrification into canisters at the Defense Waste Processing Facility and disposition of decontaminated salt solution in Saltstone Disposal Units. The FY 2022 Budget Request also supports continued risk reduction of the Nuclear Materials Program missions to store, stabilize, and disposition EM-owned nuclear materials and spent nuclear fuel, as well as support the mission for maintaining the safe and environmentally compliant state of excess nuclear processing facilities until their decommissioning. The Nuclear Materials Program missions at SRS includes funds for operations of H-Canyon, L-Basin, K-Area Facilities, and the surveillance and maintenance of excess nuclear facilities in F-Area.

- **Office of River Protection**
  $1.5B for continued progress toward important cleanup required by the Amended Consent Decree and Tri-Party Agreement. The Request is designed to maintain safe operations of the tank farms to protect workers, the public, and the environment; meet regulatory commitments; enable the development and maintenance of infrastructure necessary to enable waste treatment operations; and progress single shell tank retrievals. The FY 2022 Budget Request also supports continued progress toward the completion of the Waste Treatment and Immobilization Plant. Specifically, the Request supports completion of the Low-Activity Waste Facilities, Balance of Facilities, and Analytical Laboratory no later than December 2023 and continued design and safety documentation for the High-Level Waste Facility.

- **Richland**
  $927M for continued achievement of important cleanup progress required by the Tri-Party Agreement. It will maintain safe operations; perform Hanford site-wide services; support Direct Feed Low-Activity Waste startup and commissioning; and conduct critical site infrastructure projects. The Request also supports progress in modifications to the Waste Encapsulation and Storage Facility for transfer of the cesium-strontium capsules to dry storage by August 2025, continued groundwater treatment progress, additional progress in the remediation of the 300-296 waste site located

beneath the 324 Building, and completion of 105KW Fuel Storage Basin above and below water debris disposition and deactivation activities.

- **Oak Ridge**
  $549M for continued cleanup activities at the Oak Ridge site, including slab and soil remediation at the East Tennessee Technology Park; addressing high-risk excess contaminated facilities at ORNL and Y-12, disposition of U-233 material and transuranic waste; design for the On-Site Waste Disposal Facility to support cleanup of ORNL and Y12; and continued investment in mercury characterization and remediation technologies. The Request also continues characterization and slab and soil remediation of the East Tennessee Technology Park main plant area, Zone 2 and other activities required to close the site.

- **Idaho**
  $381M for continued progress in characterizing, packaging, and shipping stored contact-handled and remote-handled transuranic waste. The request also continues processing, characterizing, packaging, and shipping mixed low-level radioactive waste and remote-handled mixed low-level radioactive waste to off-site disposal facilities. The Request completes treatment of contact handled sludge waste and buried waste exhumations from within the final of nine retrieval enclosures, ending a decades-long effort to treat legacy waste in Idaho. The Request also continues Ft. St. Vrain and Three Mile Island Spent nuclear fuel monitoring activities.

- **Carlsbad**
  $430M for support of disposal facility operations, regulatory and environmental compliance actions, the Central Characterization Project to perform transuranic waste characterization/certification activities to maintain progress toward legacy transuranic waste related milestones at generator sites, transuranic waste transportation capabilities, continued progress on repairing or replacing infrastructure, modernizing underground equipment to zero-emission battery-electric vehicles or, where full electrification is not currently feasible, very low emission Tier IV Final diesel powered equipment as a transitional step in our conversion to zero-emissions operations, the new Safety Significant Confinement Ventilation System (15-D-411), and Utility Shaft (15-D-412).

- **Paducah**
  $259M for supporting activities to continue environmental remediation and to further stabilize the gaseous diffusion plant. The stabilization activities include non-destructive assay characterization, activities to remove hazardous materials, and surveillance and maintenance. This Request also supports the safe operation of the Depleted Uranium Hexafluoride Conversion facility.

- **Portsmouth**
  $530M for continued decontamination and decommissioning activities. This Request also supports the safe operation of the Depleted Uranium Hexafluoride Conversion facility. The FY 2022 Budget Request includes funding to construct an on-site facility for the disposal of debris generated from the demolition of the Portsmouth Gaseous Diffusion Plant and associated facilities.

- **Los Alamos National Laboratory**
  $334M to continue to focus on the removal of legacy waste, soil and groundwater cleanup, and protection of surface water at the Los Alamos National Laboratory. The Chromium Plume Control Interim Measure to control migration of a hexavalent chromium plume beneath Mortandad and Sandia Canyons will continue. Additionally, Plume-Center Characterization activities will continue to investigate and develop corrective measures for remediation of the hexavalent chromium plume, and design will be initiated for the proposed remedies. Investigation and characterization of groundwater for the Royal Demolition Explosives plume in Cañon de Valle will continue. Remediation of the Middle DP Road Site and continued implementation of the individual storm water permit will continue, and investigation and cleanup of several aggregate areas will be completed. Characterization and cleanup at Technical Area 21 will continue as well as retrieval and repackaging of the below-grade transuranic waste to include readiness activities and infrastructure needs to manage the processing and packaging of the waste at Area G. Also, planning on Deactivation and Decommissioning of proposed National Nuclear Security Administration excess facilities will be initiated.

ENSURING THE NATION'S NUCLEAR SECURITY

The National Nuclear Security Administration (NNSA) request is $19.7B to support the security and safety of our Nation. NNSA's FY 2022 Budget Request pursues five major national security endeavors: (1) maintain a safe, secure, and effective nuclear weapons stockpile; (2) reduce global nuclear threats and keep materials out of the hands of terrorists; (3) strengthen key science, technology and engineering capabilities in support of certification, assessment, and current and future stockpile modernization programs; (4) provide safe and militarily-effective integrated nuclear propulsion systems for the U.S. Navy; and (5) modernize the nuclear security infrastructure and provide necessary federal oversight for growing mission requirements. NNSA has pursued a disciplined process to meet nuclear security and nonproliferation policy goals and requirements, support the Navy, and support a highly skilled federal workforce. The Request continues to modernize America's nuclear stockpile and infrastructure, and the underlying science that supports strategic decisions and certification of the stockpile. The Request supports the U.S Navy's nuclear fleet through safe and effective integrated nuclear propulsion systems, and supports the nonproliferation goals outlined in the President's *Interim National Security Strategic Guidance*.

Highlights include:

- $15.5B for Weapons Activities for the maintenance and refurbishment of nuclear weapons to continue sustained confidence in their safety, reliability, and performance; continued investment in scientific, engineering, and manufacturing capabilities to enable production and certification of the enduring nuclear weapons stockpile; and manufacture of nuclear weapon components. Weapons Activities also provides for continued maintenance and investment in the NNSA Nuclear Security Enterprise to be more responsive and resilient. A key priority is rebuilding the production capability and capacity to produce necessary warhead components.
    - $4.6B for Stockpile Management to support stockpile sustainment, dismantlement, and modernization of the nuclear weapons program. The Request funds major stockpile modernization programs, including life extension programs; required stockpile sustainment activities to include maintenance, surveillance, assessment, development, and program planning; safe and secure dismantlement of nuclear weapons and components in accordance with the Nuclear Weapons Stockpile Plan; and sustainment of manufacturing capabilities and capacities, including process improvements and investments focused on increased efficiency of production operations.
    - $2.9B for Production Modernization to support the production capabilities of nuclear weapons components critical to weapon performance, including primaries, secondaries, radiation cases, and non-nuclear components. The Request funds work supporting site preparation, long-lead procurements, and preliminary design for the Savannah River Plutonium Processing Facility and the Los Alamos Plutonium Pit Production Project.
    - $2.7B for Stockpile Research, Technology, and Engineering to provide the knowledge and expertise needed to maintain confidence in the nuclear stockpile without additional nuclear explosive testing. The Request funds the continued implementation of the Enhanced Capabilities for Subcritical Experiments and various activities in preparation to accept and operate NNSA's first exascale high performance computing system for program use in 2023. Funding also supports the development of new materials, technologies, and processes to evolve nuclear systems and production complex.
    - $3.6B for Infrastructure and Operations to continue the long-term effort to modernize NNSA infrastructure. This includes funding to support additional leased space at Kansas City to meet Life Extension Program (LEP) schedules; increased resources at Tritium facilities to meet LEP production needs at the Savannah River Site; and funds to strategically target essential real property and programmatic equipment recapitalization requirements. The request also includes funding for the Uranium Processing Facility at Y-12; the Chemistry and Metallurgy Research Replacement project; the U1a Complex Enhancements Project; the Lithium Processing Facility; the Tritium Finishing Facility; a new start for the Power Sources Capability project; and a new start for the Digital Infrastructure Capability Expansion project at LLNL.
- $2.3B for Defense Nuclear Nonproliferation funds five programs that provide policy and technical leadership to prevent or limit the spread of weapons of mass destruction-related materials, technology, and expertise; develop technologies to detect nuclear proliferation; secure or eliminate inventories of nuclear weapons-related materials and infrastructure; and ensure technically trained emergency management personnel are available to respond to nuclear and radiological incidents and accidents domestically and overseas.

- $1.9B for Naval Reactors (NR) to continue NR's core objective of supporting the daily safe and reliable operation of the Nation's nuclear fleet. The Program's development work consists of refining and improving existing technology to ensure that the U.S. Navy's nuclear propulsion plants are increasingly efficient and effective and will be capable of meeting future threats to national security. NR supports the existing nuclear fleet and three major DOE initiatives—the Columbia-Class Reactor System Development, the Land-based S8G Prototype Refueling Overhaul, and the Spent Fuel Handling Recapitalization Project.

- The FY 2022 Budget Request includes prior year cancellations of $330 million from the Mixed Oxide Fuel Fabrication Facility within Defense Nuclear Nonproliferation and $6 million from completed construction projects within Naval Reactors.

Other Defense Activities

The FY 2022 Budget Request provides $1.2B to support defense activities conducted by the Department including Legacy Management, Environment, Health, Safety and Security, Enterprise Assessments, Specialized Security Activities, Hearings and Appeals, and Defense Related Administrative Support (DRAS). DRAS offsets administrative expenses for work supporting defense-oriented activities in Departmental Administration.

  - $429M for Legacy Management (LM) to continue its mission of serving communities that have experienced disproportionately high human health and environmental impacts. LM's mission activities includes Long-Term Surveillance and Maintenance at more than 100 sites; evaluating the condition and addressing physical safety hazards at Defense-Related Uranium Mines; Archiving and Information Management at LM's sites and field offices; post-retirement benefits to former contract workers; asset management, environmental justice, education, communication, history, and outreach. By the end of FY 2022, LM will be responsible for long-term stewardship at 103 sites; including the newly acquired Durita, CO and Spilt Rock, WY Disposal Sites. The Request also includes $250M to support the proposal to consolidate the administration of the Formerly Utilized Sites Remedial Action Program under the Department of Energy.

ADMINISTRATION AND OVERSIGHT

- $127M for the Energy Information Administration (EIA) to continue supporting the collection, analysis, and dissemination of independent and impartial energy information and analysis to promote sound policymaking, efficient markets, and public understanding of energy and its interaction with the economy and the environment. The FY 2022 Budget Request will enable EIA to continue statistical and analysis activities that deliver valuable information to key stakeholders.

- $122M for the Office of Indian Energy Policy and Programs for financial and technical assistance to promote energy development, efficiency, and use, reducing or stabilize energy costs, strengthening energy and economic infrastructure, and bringing electrical power and service to Indian land and homes, Alaskan Native Villages, with the ancillary benefit of providing employment on Tribal Lands/Alaskan Native communities. This assistance is intended to overcome barriers to deploying energy generation (used for heat and electric power) and energy efficiency projects to reduced or stabilized energy costs and address energy poverty, as well as to provide power to unelectrified homes.

- $80M for the four Power Marketing Administrations (PMA) to sell electricity primarily generated by federally owned hydropower projects to public entities and electric cooperatives. Preference in the sale of power is given to public entities and electric cooperatives. Revenues from the sale of Federal power and transmission services are used to repay all related power and transmission costs.

- Loan Program Office:
  - Title 17 Innovative Technology Loan Guarantee Program
    $179M of which $150M is for the credit subsidy costs associated with an additional $1.5 billion of guaranteed loan authority and $29M ($32M minus $3M offsetting collections) for administrative expenses. The program will accelerate the deployment of innovative energy projects to help launch new energy markets, reduce harmful pollutants, and drive American economic growth. It will provide flexible, custom financing and access to debt capital that helps to meet the specific needs of individual borrowers, and new loan authority and credit subsidy to provide debt capital for innovative electric vehicle infrastructure, carbon management, and other clean energy projects that create good paying jobs with a free and fair choice to join a union.

- Advanced Technology Vehicles Manufacturing (ATVM)
  $5M for the continuation of the ATVM Program in its loan originating and portfolio monitoring responsibilities. No additional loan authority is requested for FY 2022, with $17.7 billion remaining in loan authority to catalyze domestic manufacturing of fuel efficient, light-duty passenger vehicles and eligible components. The Administration believes the definition of advanced technology vehicles should be expanded to fully leverage the ATVM program to reduce transportation emissions and create good paying jobs that provide the free and fair choice to join a union. The FY 2022 Budget Request will allow LPO to continue outreach and origination activities, including developing marketing materials and engaging in stakeholder outreach.

- Tribal Energy Loan Guarantee Program (TELGP)
  $2M to continue TELGP loan guarantee originating activities, as well as to monitor its expected portfolio. No additional loan authority is requested for the FY 2022 Budget Request. The Request will also allow LPO to continue outreach and origination activities, including developing marketing materials, engaging in stakeholder outreach, and ensuring that LPO's unique value proposition is widely known across Indian tribes and Alaska Native Corporations.

Additional Administration and Oversight Activities

The FY 2022 Budget Request includes $400M for Administration and Oversight activities, including Departmental Administration (DA), the Office of the Inspector General, and offsets. In FY 2022, the Office of Technology Transitions ($19M) is requested as a separate appropriation outside of Departmental Administration (DA). The Office of Strategic Planning and Policy (formerly the Office of Policy) is expanding in size and mission scope, to include energy jobs and arctic energy functions. The Office of Economic Impact and Diversity is consolidating Equal Employment Opportunity functions and staff across DOE and expanding its mission to include energy justice activities and programs across the complex. Additionally, the Office of Management is requesting $16 million to facilitate the government-wide transition from GSA-leased gas-powered vehicles to GSA-leased Zero Emission Vehicles; this funding also includes related charging infrastructure and program management costs. To address vulnerabilities identified after the December 2020 SolarWinds intrusion, the Department is requesting approximately $93 million for cyber response and recovery management through the Office of the Chief Information Officer for the DOE enterprise.

Highlights include:

ADMINISTRATION AND OVERSIGHT
FY 2022

	$K
Administration and Oversight	**400**
Savings and Receipts	***-20***

- $322M for DA to fund management and mission support organizations that have enterprise-wide responsibility for international engagement and promotion of global market opportunities, administration, accounting, budgeting, contract and project management, human resources, congressional and intergovernmental liaison, energy policy, information management, life-cycle asset management, legal services, workforce diversity and equal employment opportunity, ombudsman services, small business advocacy, sustainability, and public affairs.

- $78M for Office of the Inspector General to review the integrity, economy, and efficiency of DOE programs and operations, including NNSA and the Federal Energy Regulatory Commission. Beginning in FY 2022, the OIG will begin conducting, or arranging for, independent incurred cost audits of the Department's Management and Operating Contracts, valued at over $17 billion, as opposed to relying on the Cooperative Audit Strategy that has been in place since 1994. The OIG has budgeted $18.75 million to assume responsibility for the incurred cost audits work.

- $1.5M for operations of the Artificial Intelligence Technology Office (AITO). AI is a foundational technology that will drive decades of innovation. AITO leads Department-wide coordination efforts to evaluate the scope and effectiveness of DOE's AI programs and identify gaps not addressed by programs, functional offices, sites, or associated National Laboratories.

- In FY 2022, the Office of Technology Transitions is funded under a new, separate appropriation. The FY 2022 Budget Request provides $19M to increase transparency and reflect the need for multi-year funding for programmatic activities, including: Technology Commercialization Fund; Energy I-Corps; Lab Partnering Service; Market Analysis; and Energy Program for Innovation Clusters (EPIC). The level of requested funding will allow OTT to meet its statutory

requirements under the Energy Act of 2020, including increases for strategic mission areas including market and supply chain analysis and staffing increases to support an expanded program and outreach portfolio.

- -$20M in receipts from the Federal Energy Regulatory Commission fees (-$9M) and Title XVII Loan Guarantee Negative Credit Subsidies (-$11M).

AMERICAN JOBS PLAN

On March 31, 2021, the Administration released the outline of American Jobs Plan (AJP), an investment in the Nation that will create millions of good jobs and rebuild our country's infrastructure. While the previously enacted American Rescue Plan focused on the COVID-19 pandemic and delivered relief to working families, the Administration views the AJP is a vehicle for rebuilding a new economy. A foundation for the AJP is the President's Build Back Better platform which will unify and mobilize the Nation to meet the climate crisis challenges of our time as well as invest in Americans and deliver the jobs and opportunities they deserve. But unlike past major investments, the plan prioritizes addressing long-standing and persistent racial injustice. The AJP targets 40 percent of the benefits of climate and clean infrastructure investments to disadvantaged communities. And, the plan invests in rural communities and communities impacted by the market-based transition to clean energy.

As specific funding details of the American Jobs Plan are forthcoming, DOE's FY 2022 Budget Request materials do not include specific references to funding the initiatives included in the AJP. In total, the plan will invest about $2 trillion this decade. Of this amount, there is more than $131B in direct spending explicitly for DOE, in addition to cross cutting programs, spread over a period of six years. This is in addition to the funding included in the President's FY 2022 Budget Request.

CONCLUSION

The Department of Energy FY 2022 Budget Request provides for America's future by Advancing Clean Energy Innovation, Tackling the Climate Crisis, Ensuring the Nation's Nuclear Security and Sustaining Investment in Environmental Clean-Up and creating good paying jobs that provide the free and fair chance to join a union and collectively bargain. The Request demonstrates fiscal discipline and commitment to an efficient and effective Federal government. To that end, DOE will focus spending in areas with the highest return on investment of taxpayer dollars. Achieving goals established in the Request requires an exceptional workforce. The Department will invest in the workforce by attracting, training, and retaining the Nation's best talent. The FY 2022 Budget Request supports the critical role the Department of Energy has in supporting the Nations' prosperity by addressing its energy, environmental, and nuclear security challenges through transformative science and technology solutions. The FY 2022 Budget Request creates jobs through clean energy projects, brings American to the forefront of clean energy innovation; tackles the climate crisis with the urgency science demands; invests in communities that have been left behind; and ensures the safety and security of the nuclear stockpile. The Department appreciates the support of Congress and is eager to get to work.

DEPARTMENT OF ENERGY
Appropriation Summary
FY 2022
(Dollars in Thousands)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs. FY 2021 Enacted $	FY 2022 Request vs. FY 2021 Enacted %
Department of Energy Budget by Appropriation					
Energy Efficiency and Renewable Energy	2,777,277	2,861,760	4,732,000	+1,870,240	+65.35%
Electricity	190,000	211,720	327,000	+115,280	+54.45%
Cybersecurity, Energy Security and Emergency Response	156,000	156,000	201,000	+45,000	+28.85%
Strategic Petroleum Reserve	195,000	188,000	197,000	+9,000	+4.79%
Naval Petroleum and Oil Shale Reserve	14,000	13,006	13,650	+644	+4.95%
Strategic Petroleum Reserve Petroleum Account	10,000	1,000	7,350	+6,350	+635.00%
Northeast Home Heating Oil Reserve	10,000	6,500	0	-6,500	-100.00%
Total, Petroleum Reserve Accounts	229,000	208,506	218,000	+9,494	+4.55%
Total, Cybersecurity, Energy Security, and Emergency Response	385,000	364,506	419,000	+54,494	+14.95%
Nuclear Energy (270)	1,340,000	1,357,800	1,700,700	+342,900	+25.25%
Fossil Energy and Carbon Management	750,000	750,000	890,000	+140,000	+18.67%
Total, Fossil Energy Programs	**750,000**	**750,000**	**890,000**	**140,000**	**+18.67%**
Uranium Enrichment Decontamination and Decommissioning (D&D) Fund	881,000	841,000	831,340	-9,660	-1.15%
Energy Information Administration	126,800	126,800	126,800	+0	+0.00%
Non-Defense Environmental Cleanup	319,200	319,200	338,860	+19,660	+6.16%
Science	7,000,000	7,026,000	7,440,000	+414,000	+5.89%
Office of Technology Transitions (OTT)	0	0	19,470	+19,470	N/A
Office of Clean Energy Demonstration (OCED)	0	0	400,000	+400,000	N/A
Advanced Research Projects Agency - Energy	425,000	427,000	500,000	+73,000	+17.10%
Advanced Research Projects Agency - Climate	0	0	200,000	+200,000	N/A
Nuclear Waste Disposal	0	27,500	7,500	-20,000	-72.73%
Departmental Administration	161,000	166,000	321,760	+155,760	+93.83%
Indian Energy Policy and Programs	22,000	22,000	122,000	+100,000	+454.55%
Inspector General	54,215	57,739	78,000	+20,261	+35.09%
Title 17 Innovative Technology Loan Guarantee Program	29,000	-363,000	179,000	+542,000	-149.31%
Advanced Technology Vehicles Manufacturing Loan Program	5,000	-1,903,000	5,000	+1,908,000	-100.26%
Tribal Energy Loan Guarantee Program	2,000	2,000	2,000	+0	+0.00%
Total, Credit Programs	**36,000**	**-2,264,000**	**186,000**	**2,450,000**	**-108.22%**
Total, Energy Programs	**14,467,492**	**12,295,025**	**18,640,430**	**6,345,405**	**+51.61%**
Federal Salaries and Expenses	434,699	443,200	464,000	+20,800	+4.69%
Weapons Activities	12,457,097	15,345,000	15,484,295	+139,295	+0.91%
Defense Nuclear Nonproliferation	2,164,400	2,260,000	1,934,000	-326,000	-14.42%
Naval Reactors	1,648,396	1,684,000	1,860,705	+176,705	+10.49%
Total, National Nuclear Security Administration	**16,704,592**	**19,732,200**	**19,743,000**	**10,800**	**+0.05%**
Defense Environmental Cleanup	6,255,000	6,426,000	6,841,670	+415,670	+6.47%
Other Defense Activities	906,000	920,000	1,170,000	+250,000	+27.17%
Total, Environmental and Other Defense Activities	**7,161,000**	**7,346,000**	**8,011,670**	**665,670**	**+9.06%**
Nuclear Energy (050)	153,408	149,800	149,800	+0	+0.00%
Total, Atomic Energy Defense Activities	**24,019,000**	**27,228,000**	**27,904,470**	**676,470**	**+2.48%**
Southeastern Power Administration (SEPA)	0	0	0	+0	+0.00%
Southwestern Power Administration (SWPA)	10,400	10,400	10,400	+0	+0.00%
Western Area Power Administration	89,196	89,372	90,772	+1,400	+1.57%
Falcon and Amistad Operating and Maintenance Fund	228	228	228	+0	+0.00%
Colorado River Basins Power Marketing Fund *	-21,400	-21,400	-21,400	+0	+0.00%
Total, Power Marketing Administrations	**78,424**	**78,600**	**80,000**	**1,400**	**+1.78%**
Federal Energy Regulatory Commission	0	0	0	+0	+0.00%
Total, Energy and Water Development and Related Agencies	**38,564,916**	**39,601,625**	**46,624,900**	**7,023,275**	**+17.73%**
Excess Fees and Recoveries, FERC	-16,000	-9,000	-9,000	+0	+0.00%
Title XVII Loan Guar. Prog Section 1703 Negative Credit Subsidy Receipt	-15,000	0	-10,800	-10,800	N/A
UED&D Fund Offset	0	0	-415,670	-415,670	N/A
Discretionary Funding by Appropriation	**38,533,916**	**39,592,625**	**46,189,430**	**+6,596,805**	**+16.66%**
DOE Budget Function	**38,533,916**	**39,592,625**	**46,189,430**	**+6,596,805**	**+16.66%**
NNSA Defense (050) Total	16,704,592	19,732,200	19,743,000	+10,800	+0.05%
Non-NNSA Defense (050) Total	7,314,408	7,495,800	8,161,470	+665,670	+8.88%
Defense (050)	*24,019,000*	*27,228,000*	*27,904,470*	*676,470*	*2.48%*
Science (250)	7,000,000	7,026,000	7,440,000	+414,000	+5.89%
Energy (270)	7,514,916	5,338,625	10,844,960	+5,506,335	+103.14%
Non-Defense (Non-050)	*14,514,916*	*12,364,625*	*18,284,960*	*5,920,335*	*47.88%*

* Amount has been adjusted per Section 127 of Public Law 116-159, Continuing Appropriations Act, 2021 and Other Extensions Act.

DEPARTMENT OF ENERGY
Organization Summary
FY 2022
(Dollars in Thousands)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs. FY 2021 Enacted $	FY 2022 Request vs. FY 2021 Enacted %
Department of Energy Budget by Organization					
Undersecretary for Nuclear Security and National Nuclear Security Administration					
National Nuclear Security Administration					
Weapons Activities	12,457,097	15,345,000	15,484,295	+139,295	+0.91%
Defense Nuclear Nonproliferation	2,164,400	2,260,000	1,934,000	-326,000	-14.42%
Naval Reactors	1,648,396	1,684,000	1,860,705	+176,705	+10.49%
Federal Salaries and Expenses	434,699	443,200	464,000	+20,800	+4.69%
Total, National Nuclear Security Administration	16,704,592	19,732,200	19,743,000	+10,800	+0.05%
Undersecretary for Science and Energy					
Science	7,000,000	7,026,000	7,440,000	+414,000	+5.89%
Energy Efficiency and Renewable Energy	2,777,277	2,861,760	4,732,000	+1,870,240	+65.35%
Electricity	190,000	211,720	327,000	+115,280	+54.45%
Power Marketing Administrations (PMAs) *	78,424	78,600	80,000	+1,400	+1.78%
Cybersecurity, Energy Security, and Emergency Response	156,000	156,000	201,000	+45,000	+28.85%
Petroleum Reserves					
Naval Petroleum & Oil Shale Reserves	14,000	13,006	13,650	+644	+4.95%
Strategic Petroleum Reserves	195,000	188,000	197,000	+9,000	+4.79%
SPR - Petroleum Account	10,000	1,000	7,350	+6,350	+635.00%
Northeast Home Heating Oil Reserves	10,000	6,500	0	-6,500	-100.00%
Subtotal, Petroleum Reserves	229,000	208,506	218,000	+9,494	+4.55%
Total, Cybersecurity, Energy Security, and Emergency Response & Petroleum Reser	**385,000**	**364,506**	**419,000**	**+54,494**	**+14.95%**
Fossil Energy and Carbon Management RD&D	750,000	750,000	890,000	+140,000	+18.67%
Nuclear Energy	1,493,408	1,507,600	1,850,500	+342,900	+22.74%
Nuclear Waste Disposal	0	27,500	7,500	-20,000	-72.73%
Office of Technology Transitions	14,080	17,639	19,470	+1,831	+10.38%
Artificial Intelligence & Technology Office	2,500	2,500	1,500	-1,000	-40.00%
Indian Energy Policy & Programs	22,000	22,000	122,000	+100,000	+454.55%
Loan Program Offices	36,000	-2,264,000	186,000	+2,450,000	-108.22%
Total, Undersecretary for Science and Energy	12,748,689	10,605,825	16,074,970	+5,469,145	+51.57%
Undersecretary (S3)					
Environment, Health, Safety and Security	207,839	206,320	206,320	+0	+0.00%
Project Management Oversight & Assessments	12,596	13,000	13,307	+307	+2.36%
Total, Undersecretary (S3)	220,435	219,320	219,627	+307	+0.14%
Direct Reports					
Environmental Management	7,455,200	7,586,200	8,011,870	+425,670	+5.61%
Non-Defense Environmental Cleanup	319,200	319,200	338,860	+19,660	+6.16%
Uranium Enrichment Decontamination and Decommissioning Fund	881,000	841,000	831,340	-9,660	-1.15%
Defense Environmental Cleanup	6,255,000	6,426,000	6,841,670	+415,670	+6.47%
Legacy Management	162,029	163,059	428,730	+265,671	+162.93%
Enterprise Assessments	78,779	79,070	83,384	+4,314	+5.46%
Specialized Security Activities	273,409	283,500	283,500	+0	+0.00%
Office of Hearings And Appeals	4,852	4,262	4,356	+94	+2.21%
Office of Clean Energy Demonstrations	0	0	400,000	+400,000	N/A
Advanced Research Projects Agency- Energy	425,000	427,000	500,000	+73,000	+17.10%
Advanced Research Projects Agency- Climate	0	0	200,000	+200,000	N/A
Energy Information Administration	126,800	126,800	126,800	+0	+0.00%
Office of the Secretary	5,119	5,582	5,582	+0	+0.00%
Congressional & Intergovernmental Affairs	4,395	5,000	6,000	+1,000	+20.00%
Office of the Chief Financial Officer	52,000	53,590	56,591	+3,001	+5.60%
Economic Impact & Diversity	10,169	10,169	20,000	+9,831	+96.68%
Office of International Affairs	26,825	26,825	30,500	+3,675	+13.70%
Chief Information Officer	140,200	140,200	232,258	+92,058	+65.66%
Office of Management	54,358	54,358	75,358	+21,000	+38.63%
Office of Human Capital Management	24,316	24,918	28,250	+3,332	+13.37%
Office of Small & Disadvantaged Business Utilization	3,337	3,386	3,752	+366	+10.81%
General Counsel	32,575	35,000	38,000	+3,000	+8.57%
Office of Policy	7,000	7,000	28,996	+21,996	+314.23%
Public Affairs	4,000	4,000	5,954	+1,954	+48.85%
Office of Inspector General	54,215	57,739	78,000	+20,261	+35.09%
Total, Direct Reports	8,944,578	9,097,658	10,647,881	+1,550,223	+17.04%
Miscellaneous Revenues	-53,378	-53,378	-60,578	-7,200	+13.49%
Federal Energy Regulatory Commission	**0**	**0**	**0**	+0	N/A
Receipts and offsets					
Excess Fees and Recoveries, FERC	-16,000	-9,000	-9,000	+0	+0.00%
Title XVII Loan Guar. Prog Section 1703 Negative Credit Subsidy Receipt	-15,000	0	-10,800	-10,800	N/A
UED&D Fund Discretionary Payments	0	0	-415,670	-415,670	N/A
Receipts	-31,000	-9,000	-435,470	-426,470	+4,738.56%
Total, Department of Energy	**38,533,916**	**39,592,625**	**46,189,430**	**+6,596,805**	**+16.66%**

* Amount has been adjusted per Section 127 of Public Law 116-159, Continuing Appropriations Act, 2021 and Other Extensions Act.

Program and Functional Office Details

($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted	
				$	%
Office of Science					
Advanced Scientific Computing Research	980,000	1,015,000	1,040,000	+25,000	+2.46%
Basic Energy Sciences	2,213,000	2,245,000	2,300,000	+55,000	+2.45%
Biological and Environmental Research	750,000	753,000	828,000	+75,000	+9.96%
Fusion Energy Sciences	671,000	672,000	675,000	+3,000	+0.45%
High Energy Physics	1,045,000	1,046,000	1,061,000	+15,000	+1.43%
Nuclear Physics	713,000	713,000	720,000	+7,000	+0.98%
Isotope R&D and Production	–	–	90,000	+90,000	–
Accelerator R&D and Production	–	–	24,000	+24,000	–
Workforce Development for Teachers and Scientists	28,000	29,000	35,000	+6,000	+20.69%
Science Laboratories Infrastructure	301,000	240,000	295,000	+55,000	+22.92%
Safeguards and Security	112,700	121,000	170,000	+49,000	+40.50%
Program Direction	186,300	192,000	202,000	+10,000	+5.21%
Total, Office of Science	**7,000,000**	**7,026,000**	**7,440,000**	**+414,000**	**+5.89%**

Appropriation Overview

The Office of Science (SC) is the nation's largest Federal supporter of basic research in the physical sciences and funds programs in physics, chemistry, materials science, biology, environmental science, applied mathematics, isotope research and production, accelerator research and production, and computer and computational science. The SC portfolio has two principal thrusts: direct support of scientific research and direct support of the design, development, construction, and operation of unique, open-access scientific user facilities. The SC basic research portfolio includes extramural grants and contracts supporting nearly 28,000 researchers located at over 300 institutions and the 17 DOE national laboratories, spanning all fifty states and the District of Columbia. The portfolio of 28 scientific user facilities serves over 36,000 users per year. SC programs invest in foundational science, including basic research for the advancement of clean energy, to transform our understanding of nature and strengthen the connection between advances in fundamental science and technology innovation.

The SC Request increases investments in Administration priorities including basic research on climate change and clean energy, fundamental science to transform manufacturing, and biopreparedness. SC initiates a new activity, Reaching a New Energy Sciences Workforce (RENEW), for targeted efforts to increase participation and retention of underrepresented groups in SC research activities. The request also supports ongoing investments in priority areas including microelectronics, critical materials, quantum information science (QIS), artificial intelligence (AI) and machine learning (ML), exascale computing, integrated computational and data infrastructure for scientific discovery, and accelerator science and technology.

Program Highlights

- **Advanced Scientific Computing Research**
  Advanced Scientific Computing Research (ASCR) advances science and U.S. competitiveness through investments in computational research, applied mathematics, and computer science, as well as development and operation of multiple, large, high performance and leadership computing user facilities and high performance networking. The efforts prioritize basic research in applied mathematics and computer science with emphasis on the challenges of data intensive science, including AI and ML, and future computing technologies. The Request increases support for ASCR's Computational Partnerships with a focus on developing partnerships in quantum computing and data intensive

applications, and new partnerships that broaden the impact of both exascale and data infrastructure investments in areas of importance to DOE and SC. The Request funds:

- Final research and development activities within the Exascale Computing Project (ECP) and full scale runs to deliver project performance targets on the Nation's first exascale system, Frontier, which is projected to achieve exascale-capable systems with a five-fold improvement in true application performance over the Summit system at the Oak Ridge Leadership Computing Facility. During FY 2022, Frontier will primarily support ECP and early science applications, as well as debugging and system stabilization efforts. Innovative and Novel Computational Impact on Theory & Experiment (INCITE) and ASCR Leadership Computing Challenge projects that are ready for exascale and understand the limitations of a pre-production team, including industry and Gordon Bell applications, will also be given access as appropriate.
- Foundational research to improve the robustness, reliability, and transparency of Big Data and AI technologies, uncertainty quantification, and development of software tools and continuation of an activity to deploy AI software and technologies to create an integrated computational and data infrastructure across the SC programs, scientific user facilities, and laboratories.
- Core research in applied mathematics and computer science, the Scientific Discovery through Advanced Computing (SciDAC) program, and strategic partnerships aimed at understanding the challenges that emerging technologies such as artificial Intelligence, quantum information science, and neuromorphic processors pose to DOE mission applications.
- Support for partnerships with Basic Energy Sciences, Fusion Energy Sciences, High Energy Physics, and Nuclear Physics in microelectronics, and new data and partnerships with the National Institutes of Health (NIH), as well as engagements with other agencies to improve our ability to assist in times of national emergencies.
- In partnership with other SC programs, continuing support for the QIS Research Centers to promote basic research and early-stage development to accelerate the advancement of QIS through vertical integration between systems, theory, hardware, and software. In addition to the QIS centers, support for early stage research associated with the first steps to establish a dedicated Quantum Network as well as research in quantum algorithms, applications, and testbeds.
- Operations and upgrade projects at ASCR's four scientific user facilities, including final site preparations and non-recurring engineering efforts, as well as installation and testing activities at the Argonne Leadership Computing Facility in preparation for the deployment of the Nation's second exascale system.

- **Basic Energy Sciences**

  Basic Energy Sciences (BES) supports fundamental research to understand, predict, and ultimately control matter and energy at the electronic, atomic, and molecular levels in order to provide the foundations for new energy technologies, to mitigate the environmental impacts of energy use, and to support DOE missions in energy, environment, and national security. The Request funds:

  - Core research activities to support Administration Priorities on clean energy (carbon capture, hydrogen, solar, etc.); related topics such as critical materials and transformative manufacturing (including polymer upcycling and next-generation microelectronics); and cross-cutting priorities for national preparedness, QIS, data analytics/machine learning and integrated infrastructure for data-driven science (AI/ML), exascale computing, and accelerator science and technology.
  - Continuing support for the Energy Frontier Research Centers, as well as the Batteries and Energy Storage and the Fuels from Sunlight Energy Innovation Hub programs.
  - Computational materials and chemical sciences to deliver shared software infrastructure to the research communities as part of the Exascale Computing Initiative.
  - In partnership with other SC programs, continuing support for the QIS Research Centers to promote basic research and early-stage development to accelerate the advancement of QIS through vertical integration between systems and theory, hardware, and software.
  - Continuing operation of BES scientific user facilities at near-optimal levels: five x-ray light sources, two neutron scattering sources, and five research centers for nanoscale science.
  - Seven ongoing construction projects: the Advanced Photon Source Upgrade(APS-U), the Advanced Light Source Upgrade (ALS-U), the Linac Coherent Light Source-II (LCLS-II), the Linac Coherent Light Source-II High Energy (LCLS-II-HE), the Proton Power Upgrade (PPU), the Second Target Station (STS), and the Cryomodule Repair and Maintenance Facility (CRMF).

- Continuing support for two Major Item of Equipment projects: the NSLS-II Experimental Tools-II (NEXT-II) project to continue the phased build-out of beamlines at NSLS-II, and the Nanoscale Science Research Centers Recapitalization project.

- **Biological and Environmental Research**

  Biological and Environmental Research (BER) supports fundamental research to understand complex biological, biogeochemical, and physical principles of natural systems at scales extending from the genome of microbes and plants to the environmental and ecological processes at the scale of the planet Earth. BER's support of basic research will contribute to a future of stable, reliable, and resilient energy sources and infrastructure, that will lead to climate solutions, strengthen economic prosperity and assure environmental justice. The Request funds:

  - Core research in biological systems science using approaches such as genome sequencing, secure biodesign, proteomics, metabolomics, structural biology, high-resolution imaging and characterization, including full support of the Bioenergy Research Centers. Integration of this experimental biological information into computational models for iterative testing and validation to advance a predictive understanding of biological systems for use in secure, clean, affordable, and reliable energy for adaptation to industry, as well as contributing to QIS.
  - Initiation of new Urban Integrated Field Laboratories that combine modeling and observations of emerging energy technologies in urban regions, enabling the evaluation of the societal and environmental impacts of current and future energy policies.
  - Establishment of the National Virtual Climate Laboratory (NVCL) serving as a one stop portal to advance access to climate science from the DOE National Laboratories. The NVCL engagement with the science community will focus on Minority Serving Institutions and Historically Black Colleges or Universities for the local to regional climate science.
  - Planning for a National Climate Laboratory or Center, affiliated with an HBCU, facilitating translation of BER investments in foundational climate research into actionable solutions for impacted communities and addressing the Administration priorities involving climate solutions and environmental justice.
  - New efforts in advanced manufacturing for novel polymer upcycling approaches, as well as new bio-based materials and foundational bioenergy research underpinning new biotechnology and the bioeconomy.
  - New efforts in Biopreparedness Research Virtual Environment (BRaVE), a distributed framework to rapidly activate, integrate, and coordinate the expertise and research capabilities (experimental and computational) across the whole DOE National Laboratory Complex to address urgent research needs in an emerging national or international crisis.
  - Core research in earth and environmental systems science, with activities focused on scientific analysis and modeling of the sensitivity and uncertainty of Earth system predictions to atmospheric, cryospheric, oceanic, and biogeochemical processes, with continued support of the Energy Exascale Earth System Model.
  - Continuing operation and equipment refresh of the three BER scientific user facilities: the Joint Genome Institute, the Atmospheric Radiation Measurement Research Facility, and the Environmental Molecular Sciences Laboratory.

- **Fusion Energy Sciences**

  Fusion Energy Sciences (FES) supports research to understand matter at very high temperatures and densities and to build the scientific foundation needed to develop a fusion energy source. The Request is aligned with the recommendations of the recent Long-Range Plan (LRP) developed by the Fusion Energy Sciences Advisory Committee and funds:

  - Research and facility operations at the DIII-D national fusion facility at 90% of the optimal run time to optimize the tokamak approach to magnetic confinement fusion.
  - The National Spherical Torus Experiment-Upgrade (NSTX-U) recovery to implement repairs and corrective actions required to obtain robust, reliable research operations, and enhanced collaborative research at other facilities to support NSTX-U research program priorities.
  - Research opportunities for U.S. scientists at overseas superconducting tokamaks and stellarators and other international facilities with unique capabilities, enabled by U.S. hardware and intellectual contributions.
  - In partnership with other SC programs, continuing support for the SC QIS Research Centers to promote basic research and early-stage development to accelerate the advancement of QIS through vertical integration between systems and theory, hardware, and software. In addition, provides support for a core research portfolio to advance developments in fusion-relevant QIS and related technology.

- Research in AI/ML, strategic accelerator technology, and advanced manufacturing.
- Following the guidance in the LRP, research activities in Materials, Fusion Nuclear Science, and Enabling R&D are enhanced.
- Support for SciDAC in partnership with the ASCR program, research in High-Energy-Density Laboratory Plasma science including LaserNetUS, and General Plasma Science including low-temperature plasmas and microelectronics.
- Partnerships with the private sector through the Innovation Network for Fusion Energy (INFUSE) program.
- The U.S. Contributions to ITER project, focusing on the highest-priority First Plasma hardware components, including the continued fabrication of the central solenoid superconducting magnet modules. Along with providing our share of the hardware contribution as part of Subproject 1, FES is also providing a cash contribution which supports the ITER Organization in the installation and assembling of the device.
- An ITER Research program to start preparing the U.S. fusion community to take full advantage of ITER Operations after First Plasma.
- Funding to support the Matter in Extreme Conditions Petawatt upgrade project at the Linac Coherent Light Source User Facility.
- Support for the Materials-Plasma Exposure eXperiment project, which will be a world-leading facility for dedicated studies of reactor-relevant heat and particle loads on fusion materials, as it moves towards development of a cost and schedule baseline (Critical Decision-2).
- New support for Fusion Facilities Studies to address one of the highest recommendations in the LRP for the design of a Fusion Pilot Plant.

- **High Energy Physics**

  High Energy Physics (HEP) supports research to understand how the universe works at its most fundamental level, enabling the discovery of the most elementary constituents of matter and energy, the probing of the interactions among them, and the exploration of the basic nature of space and time. The Request provides support to foster a diverse, highly skilled, American workforce, to build R&D capacity, to spur technology innovation, and to conduct world-leading R&D. The Request funds:

  - Core research activities, with emphasis on the physics of the Higgs boson, neutrinos, dark matter, and dark energy; exploring the unknown; and enabling early and visible scientific results from HEP project investments.
  - QIS co-development of quantum information, theory, and technology with core research activities, and pursuit of new capabilities in sensing, simulation, and computing.
  - In partnership with other SC programs, continuing support for the SC QIS Research Centers to promote basic research and early-stage development to accelerate the advancement of QIS through vertical integration between systems and theory, hardware, and software.
  - AI/ML to tackle the challenges of managing increasingly high volumes and complexity of HEP data, and address cross-cutting challenges in coordination with DOE investments in exascale computing.
  - Multi-disciplinary microelectronics research, including 5G, sensor materials, devices, and advances in front-end electronics.
  - Accelerator Science and Technology to bolster mid- to long-term R&D to maintain a world-leading position in key accelerator technologies.
  - Integrated Computational and Data Infrastructure for Scientific Discovery to develop data storage capabilities to handle tens of exabytes of data from future experiments, and software development to improve the interface with SC infrastructure and ASCR-supported middleware.
  - The Fermilab Accelerator Complex and the Facility for Advanced Accelerator Experimental Tests II (FACET-II) continue operations at 90 percent of optimal.
  - Continuing support for the Fermi National Accelerator Laboratory (FNAL)-hosted line-item construction projects: Long Baseline Neutrino Facility/Deep Underground Neutrino Experiment (LBNF/DUNE), Proton Improvement Plan II (PIP-II), and Muon to Electron Conversion Experiment (Mu2e); and four Major Item of Equipment (MIE) projects: Cosmic Microwave Background Stage 4 (CMB-S4), High Luminosity Large Hadron Collider (HL-LHC) Accelerator Upgrade Project, and the HL-LHC ATLAS and CMS Detector Upgrade Projects. The Request also includes one new MIE start, the Accelerator Controls Operations Research Network (ACORN). Modernizing the FNAL accelerator control system, which dates from the original 1970s construction, will enable more precise and efficient operations, resulting in better performance and lower costs.

- The Accelerator Stewardship subprogram moves to the Accelerator R&D and Production program in the FY 2022 Request.

- **Nuclear Physics**

  Nuclear Physics (NP) supports research to discover, explore, and understand all forms of nuclear matter. The Request funds:

  - High priority world-class nuclear physics research and core competencies in quantum chromodynamics, nuclei and nuclear structure and astrophysics, and fundamental symmetries at universities and laboratories.
  - Operations of NP user facilities including: the Relativistic Heavy Ion Collider; the 12 GeV Continuous Electron Beam Accelerator Facility (CEBAF) ; the Argonne Tandem Linac Accelerator System; and the first year of operations at the newly constructed Facility for Rare Isotope Beams (FRIB).
  - Support for QIS efforts to enable precision NP measurements, development of quantum sensors based on atomic-nuclear interactions, and development of quantum computing algorithms, in support of the National Quantum Initiative.
  - Continued support of initiatives in microelectronics, integrated computational and data infrastructure, data analytics, and accelerator science and technology to achieve groundbreaking advances in these fields related to Nuclear Physics.
  - Completion of the FRIB construction project.
  - Continued support for R&D and design activities for the Electron Ion Collider.
  - Continued support for fabrication of new NP scientific equipment: the Gamma-Ray Energy Tracking Array MIE, which will enable the provisioning of advanced, high resolution gamma ray detection capabilities for FRIB; the sPHENIX MIE, which will have enhanced capabilities that will further RHIC's scientific mission by studying high rate jet production; the High Resolution Spectrometer (HRS) to study fast neutron beams at FRIB; the Ton-scale Neutrinoless Double Beta Decay MIE experiment to determine whether the neutrino is its own antiparticle; and the Measurement of a Lepton-Lepton Electroweak Reaction (MOLLER), which will measure the parity-violating asymmetry in electron-electron scattering with the 12 GeV CEBAF machine.

- **Isotope R&D and Production**

  Isotope R&D and Production (IRP) ensures robust supply chains of critical radioactive and stable isotopes for the Nation that no domestic entity has the infrastructure or core competency to produce. Isotopes underpin emerging technology, innovation, and a suite of research and applications that are fundamental to the Nation's prosperity, and scientific and technical leadership. The DOE Isotope Program (DOE IP) reduces the Nation's dependence on foreign supplies of key isotopes. The Request funds:

  - Research activities to support Administration and national priorities on advanced manufacturing (innovative targetry, robotics, and enrichment technologies); clean energy (isotopes for environmental research, low activation materials for reactors, and enriched isotopes for more economical reactor operations); transformative technology for producing pure isotopes for QIS; the use of AI/ML for effective operations of transformative approaches to isotope production; the promotion of National Preparedness by mitigating single point failures in domestic supply chains (radioisotope processing); and the strengthening of synergies between the DOE IP and the NIH with the targeted support of translational research to advance clinical trials for cancer and infectious disease.
  - High impact R&D activities at universities and national laboratories to develop innovative, cutting-edge isotope production and processing technologies for novel isotopes, and research to advance isotope harvesting capabilities and expertise at FRIB, and advanced processing capabilities at the University of Missouri Research Reactor (MURR).
  - The Isotope Traineeship Program to train the next generation of researchers in innovative isotope production and processing technology.
  - Mission readiness of the growing portfolio of stable and radio-isotope production and processing sites at national laboratories and universities. Capabilities include accelerators, reactors, gas centrifuge, electromagnetic ion separation, and extraction of isotopes from waste streams and legacy materials. Collections from stakeholders support the actual production costs of the isotope.
  - Support for National Isotope Development Center activities to interface with the fast growing stakeholder community and rapidly expanding isotope portfolio.
  - Continuing design and long-lead activities for the Stable Isotope Production and Research Center to mitigate U.S. dependence on foreign sources of enriched stable isotopes for research and applications. Commissioning activities for the Stable Isotope Production Facility MIE.

- Research and conceptual design for a next generation radioisotope processing facility at ORNL to make available novel isotopes and mitigate single point failures in domestic supply chains.

- **Accelerator R&D and Production**
  Accelerator R&D and Production (ARDAP) supports cross-cutting basic R&D in accelerator science and technology, access to unique SC accelerator R&D infrastructure, workforce development, and public-private partnerships to advance new technologies for use in SC's scientific facilities and in commercial products. The Request funds:

  - Innovative R&D and deployment of accelerator technology, formation of topically-focused multi-institutional collaborations for accelerator R&D, and workforce development.
  - Operation of the Brookhaven National Laboratory Accelerator Test Facility (ATF) for 2,500 hours (100 percent of optimal).
  - Public-private partnerships to develop advanced superconducting wire and cable, superconducting accelerators, and advanced radiofrequency power sources for accelerators.

- **Workforce Development for Teachers and Scientists**
  Workforce Development for Teachers and Scientists (WDTS) ensures that DOE has a sustained pipeline of science, technology, engineering, and mathematics workers to meet national goals and objectives, now and in the future. The request initiates a new SC-wide effort, Reaching a New Energy Sciences Workforce (RENEW), to increase outreach and provide workforce training opportunities at DOE laboratories for underrepresented and under-served groups.

- **Science Laboratories Infrastructure**
  Science Laboratories Infrastructure (SLI) sustains mission-ready infrastructure and safe and environmentally responsible operations by providing the infrastructure necessary to support leading edge research at the ten SC DOE national laboratories. The SLI Program is focused on not just replacing the 50 plus year old basic infrastructure supporting the SC national laboratories and the Science Mission, but to assure the new infrastructure provides for the critical needs of the future science initiatives and world class user facilities. A principal element of the SLI Program is to provide for a renewal of utilities at all SC national laboratories that will address the extraordinary challenges to SC laboratory operations particularly as they relate to climate resilience. The SLI utility projects address this issue in three important ways: (1) the improvement in operational efficiency that will significantly reduce the energy usage of the laboratory operations; (2) the reduction of the release of greenhouse gases; and (3) the direct support needed for success of the science initiatives that will help the country resolve the climate challenge. The Request funds:

  - Two new construction projects: the Critical Infrastructure Modernization Project at Oak Ridge National Laboratory (ORNL) and the Thomas Jefferson Infrastructure Improvements project at Thomas Jefferson National Acceleratory Facility (TJNAF).
  - Continuation of 16 ongoing construction projects: the Critical Utilities Rehabilitation Project and the Science User Support Center at Brookhaven National Laboratory (BNL); the Seismic and Safety Modernization project, the Linear Assets Modernization Project, and the Biological and Environmental Program Integration Center (BioEPIC) at Lawrence Berkeley National Laboratory (LBNL); the CEBAF Renovation and Expansion at TJNAF; the Translational Research Capability project at ORNL; the Critical Utilities Infrastructure Revitalization project and Large Scale Collaboration Center at SLAC National Accelerator Laboratory (SLAC); the Argonne Utilities Upgrade at Argonne National Laboratory (ANL); the Utilities Infrastructure Project and the Integrated Engineering Research Center at Fermi National Accelerator Laboratory (FNAL); the Tritium System Demolition and Disposal project, Princeton Plasma Innovation Center, and Critical Infrastructure Recovery & Renewal project at Princeton Plasma Physics Laboratory (PPPL); and the Ames Infrastructure Modernization project at Ames Laboratory.
  - General purpose infrastructure projects that will address inadequate core infrastructure and utility needs; and support for Payment in Lieu of Taxes, nuclear facilities at ORNL, and landlord responsibilities at the Oak Ridge Reservation.

- **Safeguards and Security**
  Safeguards and Security (S&S) program maintains security measures to protect personnel and assets in an environment of open scientific research. The Request funds:

- Increased funding for Cyber Security to address long standing gaps in infrastructure, operations, governance, and compliance to ensure adequate detection, mitigation, and recovery from cyber intrusions and attacks against DOE laboratories.
- Continued security operations at flat levels of effort for all remaining S&S elements.

- **Program Direction**

  Program Direction (PD) supports the skilled and motivated Federal workforce that plans, develops, and oversees SC investments in world-leading basic research and scientific user facilities, and provides critical oversight to ten of DOE's national laboratories. The Request funds Salaries and Benefits, Travel, Support Services, Other Related Expenses, and Working Capital Fund requirements.

($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted	
				$	%
Sustainable Transportation					
Vehicle Technologies	396,000	400,000	595,000	+195,000	+48.8%
Bioenergy Technologies	259,500	255,000	340,000	+85,000	+33.3%
Hydrogen and Fuel Cell Technologies	150,000	150,000	197,500	+47,500	+31.7%
Renewable Power					
Solar Energy Technologies	280,000	280,000	386,575	+106,575	+38.1%
Wind Energy Technologies	104,000	110,000	204,870	+94,870	+86.2%
Water Power Technologies	148,000	150,000	196,560	+46,560	+31.0%
Geothermal Technologies	110,000	106,000	163,760	+57,760	+54.5%
Energy Efficiency					
Advanced Manufacturing	395,000	396,000	550,500	+154,500	+39.0%
Federal Energy Management Program	40,000	40,000	438,150	+398,150	+995.4%
Building Technologies	285,000	290,000	382,000	+92,000	+31.7%
Weatherization and Intergovernmental Programs					
Weatherization Assistance Program	305,000	310,000	390,000	+80,000	+25.8%
Training and Technical Assistance	3,500	5,000	10,000	+5,000	+100.0%
Weatherization Readiness Fund	0	0	21,000	+21,000	N/A
State Energy Program	62,500	62,500	362,500	+300,000	+480.0%
Local Government Clean Energy Workforce Program	0	0	25,000	+25,000	N/A
Total, Weatherization and Intergovernmental Programs	371,000	377,500	808,500	+431,000	+114.2%
Corporate Support Programs					
Facilities and Infrastructure (NREL)	130,000	130,000	167,000	+37,000	+28.5%
21-EE-001-Energy Materials and Processing at Scale (EMAPS)	0	0	8,000	+8,000	N/A
Total, Facilities and Infrastructure	130,000	130,000	175,000	+45,000	+34.6%
Program Direction	165,000	165,000	250,000	+85,000	+51.5%
Strategic Programs	14,500	14,500	43,585	+29,085	+200.6%
Subtotal, EERE	**2,848,000**	**2,864,000**	**4,732,000**	**+1,868,000**	**+65.2%**
P.L. 116-94: Unobligated Balance Rescission	*-58,000*				
P.L. 116-94 Section 308: Energy Program Rescission	*-12,723*				
P.L. 116-260: Unobligated Balance Rescission		*-2,240*			
Total, EERE	**2,777,277**	**2,861,760**	**4,732,000**	**+1,870,240**	**+65.4%**

Appropriation Overview

The Office of **Energy Efficiency and Renewable Energy (EERE)** accelerates the research, development, demonstration, and deployment of technologies and solutions to equitably transition America to net-zero greenhouse gas emissions economy-wide by no later than 2050, creating good paying jobs, and ensuring the clean energy economy benefits all Americans, especially workers and communities impacted by the energy transition and those historically underserved by the energy system and overburdened by pollution.

EERE invests in clean energy technologies that are ready to be demonstrated and deployed, as well as R&D activities that advance early-stage technologies with a clear path to deployment. EERE's FY 2022 investment strategy focuses on making investments in five programmatic priority areas:

- *Decarbonizing the electricity sector.* To initiate a path to achieve a carbon pollution-free electricity sector no later than 2035, our focus is to support technologies that will allow us to generate all our electricity from clean, renewable

sources. To transition to a carbon-free power sector, we will need to continue to make major strides to integrate more renewable energy generation onto the grid, while ensuring it is reliable, secure, and resilient, even as it evolves.

- *Decarbonizing transportation across all modes: air, sea, rail, and road*. The transportation sector has historically relied heavily on petroleum, which supports over 90 percent of the sector's energy needs today;[1] as a result, the sector has surpassed electricity generation to become the largest source of CO_2 emissions in the country.[2] This investment aims to develop and enable new zero emission light-duty vehicle sales; address the Nation's sustainable aviation fuel demands; and increase the commercial viability of hydrogen fuel cells for long-haul heavy-duty trucks.
- *Decarbonizing energy-intensive industries*. Industrial processes currently contribute as much as 20 percent of the Nation's carbon emissions. To phase out emissions, EERE supports approaches that rely on renewable energy and fuels such as hydrogen to power industrial processes, capture and use carbon emissions, and vastly improve efficiency. EERE will develop specific roadmaps to guide research and development activities across the Department to reduce greenhouse gas (GHG) emissions. EERE will rely on renewable energy to help electrify industrial processes, use hydrogen to decarbonize industries like steel, seek to capture and use emissions, and vastly improve energy efficiency.
- *Reducing the carbon footprint of buildings*. EERE supports efforts to reduce the carbon footprint of the U.S. building stock by 50% by 2035. Such advances will be made while maintaining or improving affordability, comfort, and performance. This priority will be accomplished through three routes. First, by decarbonizing the power grid, which, in turn, decarbonizes the electricity that serves buildings. Second, by electrifying a significant share of building end uses that currently use fossil fuels, like space and water heating. Third, by significantly improving the energy efficiency of buildings and equipment, including heating and lighting systems, as well as the entire building envelope. Residential and commercial buildings are the single largest energy-consuming sector in the U.S. economy, representing approximately 39 percent of its total energy consumption and 75 percent of the Nation's electricity use. The sector is also responsible for 36 percent of energy-related carbon dioxide emissions.[3,4] As a result, Americans spend over $400 billion annually to power and otherwise energize our 129 million homes, offices, schools, hospitals, and other commercial and residential buildings.[5] However, these energy bills are not equally felt by all; the energy burden for low-income households, which typically receive a lower quality of energy services,[6] is on average three times that of non-low-income households.
- *Decarbonizing the agriculture sector, specifically focused on the nexus between energy and water.* Agriculture represents nearly 10 percent of the Nation's carbon emissions, and EERE prioritizes RD&D investments to help drive a cleaner agriculture sector while achieving our decarbonization goals. This focus includes expanding EERE's work related to reducing GHG emissions in the agricultural sector through development of biofuels, greater efficiency of off-road agricultural vehicles, on-site production of animal waste to clean energy, and better understanding and prediction of water flow to design more water and energy efficient irrigation systems. The work will be additive and complementary to the Department of Agriculture's work.

To accomplish these five programmatic priorities, EERE has identified four key emphasis areas that are inherent to all its work:

- Energy justice. It is essential that EERE's work ensures clean energy economy benefits for *all* Americans. EERE recognizes that marginalized and low-income communities have long endured disproportionate pollution to the air, water, and soil within these communities. EERE is fully committed to aligning programs and policies with the Administration's Justice40 Initiative, focused on delivering 40 percent of the benefits of Federal clean energy and climate investments to historically disadvantaged communities.
- Workforce*.* EERE is committed to an office-wide approach to workforce development, which includes identifying vocational opportunities across technologies and industry sectors, and working with labor unions, trade associations, and educational institutions to enable the training programs and career pathways needed to prepare the American workforce for millions of good-paying jobs with the free and fair chance to join a union and bargain collectively in the clean energy economy.

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[1] Transportation Energy Data Book 39th Edition, ORNL, 2021. Table 2.3 Distribution of Energy Consumption by Source and Sector, 1973 and 2019.
[2] Environmental Protection Agency, Draft U.S. Inventory of Greenhouse Gas Emissions and Sinks, 1990-2019, Table 2-11. Electric Power-Related Greenhouse Gas Emissions and Table 2-13. Transportation-Related Greenhouse Gas Emissions.
[3] ,https://www.eia.gov/environment/emissions/carbon/.
[4] U.S. Energy Information Administration. *Annual Energy Outlook 2019 with projections to 2050*. Washington, DC: U.S. Department of Energy, January 2019. https://www.eia.gov/outlooks/archive/aeo19/pdf/aeo2019.pdf.
[5] Spending derived from the U.S. Energy Information Administration Monthly Energy Review. https://www.eia.gov/totalenergy/data/monthly/.
[6] https://www.energy.gov/eere/slsc/low-income-community-energy-solutions#:~:text=According%20to%20the%20U.S.%20Department,which%20is%20estimated%20at%203%25.

- Diversity in STEM. The Request increases outreach and raises awareness of clean energy research and job opportunities at minority-serving institutions and minority professional organizations, ensuring that organizations that receive EERE funding are prioritizing diversity and equity in their own work.
- State and Local. EERE recognizes the essential role that state and local governments play in the transition to a clean energy economy; EERE works in a unified and coordinated way with its state and local partners to accelerate an equitable transition to a clean energy economy and ensure that EERE's investments benefit everyone.

Program Highlights

Sustainable Transportation supports RDD&D efforts to decarbonize transportation across all modes to enable the following: vehicle electrification; commercially viable hydrogen fuel cell trucks; sustainable aviation fuel from biomass; and waste carbon resources and low-GHG options for off-road vehicles, rail, and maritime transport.

Many newly proposed investments in this pillar are directly focused on deployment or demonstration of technology to show viable commercial paths, including a number of programmatic performance milestones by 2030 related to decarbonizing transportation across all modes. The Request in this pillar also supports hydrogen use for industrial decarbonization and energy storage as well as sustainable biomass to achieve reduced GHG from the agricultural sector.

Vehicle Technologies supports RDD&D of new, efficient, and clean mobility options that are affordable for all Americans. The Request supports increased investments to develop new innovations in vehicle technologies, leveraging the unique capabilities and world-class expertise of the National Laboratory system while deemphasizing support for RDD&D designed to expand the use of fossil-fueled internal combustion engines.

These efforts include an increased focus on funding for battery technologies research and development (R&D) to achieve by 2030 programmatic performance milestones that are critical to decarbonize transportation, as well as a carbon pollution-free electricity sector by 2035:

- Decreasing vehicle battery cell cost to achieve cost parity with internal combustion engines.
- Eliminating dependence on critical materials such as cobalt, nickel, and graphite.
- Mitigating battery supply chain risks.
- Establishing a lithium battery recycling ecosystem to recover and reintroduce spent lithium battery materials into the supply chain.

The Request also includes increased support for demonstration efforts to transition medium and heavy trucks to electrified platforms and improve efficiency of the entire freight system. In support for EERE's efforts to partner with state and local governments, the Request substantially increases support for robust local and regional partnerships to ease barriers and promote the use of new transportation technologies with a focus on reducing barriers to and leveraging opportunities for light-, medium-, and heavy-duty plug-in electric vehicle (PEV) deployment, especially in underserved communities. These activities support the Administration's goal to deploy 500,000 PEV charging stations throughout the Nation.

Bioenergy Technologies advances technologies that convert domestic biomass and other waste resources into cost effective, low-carbon biofuels and bioproducts. These technologies hold the promise of enabling a transition to a clean energy economy, creating high-quality jobs, supporting rural economies, and spurring innovation in renewable energy and chemicals production as part of the bioeconomy.

In support of EERE's objective to decarbonize all modes of transportation, the Request supports RD&D to produce "drop-in" biofuels that are compatible with existing fueling infrastructure and vehicles across a range of transportation modes, including diesel, jet, and marine fuels. This includes initial support for a Sustainable Aviation Fuel (SAF) Initiative that will support RDD&D to enable the U.S. production of the airline industry's demand for SAF.

The Request also supports a new initiative using "traditional" biofuels facilities (e.g., current ethanol plant) to demonstrate advanced technologies that have the potential to reduce GHG emissions. The Request also initiates a new effort to decarbonize the agricultural sector, helping farmers maximize profits on marginal lands while providing valuable feedstocks for bioenergy production.

Hydrogen and Fuel Cell Technologies supports efforts to enable widespread adoption of hydrogen and fuel cell

technologies. Producing affordable clean hydrogen is a key priority for EERE in conjunction with enabling diverse end uses, including: grid integration and stationary energy storage; transportation (e.g., trucks, marine, rail, aviation); chemicals (e.g., ammonia, synthetic fuels); industry (e.g., iron and steel making); backup power (e.g., emergency power, data centers); and others.

The Request represents a shift from early-stage research in fuel cells to accelerating RD&D to enable fuel cell systems that operate at a much lower cost than today's state of the art. These efforts are critical not only to decarbonize transportation, but to enable resiliency and potential future deployment of stationary fuel cells in disadvantaged communities and in poor air quality regions to address environmental justice priorities.

Likewise, the Request also represents a shift from early-stage materials research to accelerated target-driven RD&D in hydrogen technologies, with an emphasis on reducing the cost of electrolyzers, and increased funding to demonstrate the use of green hydrogen as a feedstock or direct reducing agent to decarbonize ammonia and steel production.

Renewable Power supports RDD&D efforts in solar, wind, water, and geothermal power to help reduce the costs and accelerate the use and integration of renewables, contributing to a reliable, secure, and resilient grid which, in turn, produces many thousands of good-paying jobs. This includes increased support for demonstration and validation of innovative technologies such as stationary energy storage, essential for attracting investment in renewables, as well as high impact R&D that will lay the foundation for renewable power to expand nationally and reach a carbon pollution-free electricity sector by 2035.

Solar Energy accelerates the development and deployment of solar technologies – creating many thousands of good-paying jobs in the process – while supporting the reliability, resilience, and security of the U.S. electric grid.

In FY 2022, the program will have an increased focus on the complete roadmap of solar energy implementation: advanced R&D; validation of solar technologies to invigorate American technological leadership; support for developing a robust American solar manufacturing and supply chain including demonstration and deployment of photovoltaics; training for American solar workforce; efforts to decarbonize the energy and industrial sectors; community resilience; and efforts designed to ensure the benefits of the transition to clean energy are shared with those most affected by environmental justice inequities. This includes a major emphasis on enhancing the domestic solar manufacturing and supply chain through increased funding for prize competitions designed to spur U.S. business innovation in solar, and a new initiative designed to support a qualified U.S. clean energy manufacturing workforce.

The Request also includes initial funding for the National Platform for Low-income Solar Access to spur direct adoption of rooftop solar, particularly in low-income and/or underserved communities. In support of decarbonizing industry, the Request also supports replacing the use of fossil fuels in industrial processes with concentrated solar thermal energy, with a particular focus on high-temperature processes like steel manufacturing, cement production, and chemical/fuels production.

Wind Energy supports an updated and expanded portfolio of research and innovation designed to accelerate the advancement and deployment of offshore, land-based, and distributed wind energy technologies and their integration with the electric grid. Progress on these fronts, arising from continued innovation in technology, grid systems integration, and unique solutions to deployment challenges, will drive an increase in American-made wind and create good paying jobs with the free and fair chance to join a union and bargain collectively.

To realize wind energy's full potential to the U.S. power system, the Request increases support to develop: larger, light-weight turbines that allow operation at greater heights; platforms; and turbine designs to enable ultra-large floating wind turbines—and thus access to the 58 percent of U.S. offshore wind resources that are in in deep water—and research to maximize production and efficiency from individual turbine siting and operation within a facility.

The Request also includes critical R&D to support the expansion of U.S. manufacturing capacity and domestic job creation within energy communities, including manufacturing innovations to enable highly flexible, rail-transportable blades, and support to domestic offshore wind advanced manufacturing, supply chain development, and recycling.

In addition, the Request includes increased support for cross-technology investments that leverage wind energy technologies, including a new effort to integrate and demonstrate a multi-megawatt water electrolyzer coupled with wind power generation to produce low-cost, emissions-free hydrogen, and to demonstrate the robustness of grid services, such as frequency regulation, load following, and contingency reserves.

Water Power supports a broad portfolio of research activities to strengthen the body of scientific and engineering knowledge, and support industry efforts to develop and deploy new hydropower and marine energy technologies at all scales.

The Request includes additional funding for the HydroWIRES (Water Innovation for a Resilient Energy System) initiative that enhances the ability of hydropower and pumped hydro storage (PSH) to provide increased flexibility and grid-reliability services and investigates new PSH technologies that can dramatically reduce the capital costs and barriers to new, large-scale, long-duration storage facilities. The Request also supports efforts to develop technologies designed to power non-powered dams, particularly marginal dams where developmental costs currently outweigh the power benefits.

The Request continues efforts to develop technologies to ensure safe and effective fish passage for migratory species by partnering with the National Laboratories and the private sector with an eye toward field demonstration and deployment. The Request also sustains support for marine energy, and provides funding to support the design, fabrication, and testing of marine energy conversion devices at a range of sizes, for longer term demonstrations of wave powered desalination systems for remote communities and disaster relief and recovery.

Geothermal Technologies supports the deployment of geothermal energy in both the electric and non-electric sectors to help reach a carbon pollution-free electricity sector by 2035 and a net-zero economy by 2050.

The Request initiates support for the Geothermal Energy from Oil and gas Demonstrated Engineering (GEODE) consortium designed to leverage oil and gas subsurface assets, technologies, and expertise to help solve geothermal energy's toughest challenges while providing clean energy employment opportunities for energy communities. The Request also initiates support for Geothermal Drilling Technology Demonstrations to support efforts to prove the viability of drilling technologies and methods with promise to reduce the cost of developing geothermal wells and attract private investment. Both these new investments will accelerate decarbonization of the electric sector via technology development, demonstration, and workforce transition, especially in energy communities.

Support for the Frontier Observatory in Research in Geothermal Energy (FORGE) continues, with increased support for the next FORGE R&D solicitation, enabling technological progress toward ensuring the commercial viability of enhanced geothermal systems and contributing to Administration goals for a carbon pollution-free electric sector.

The Request also initiates activities to assist Federal agencies to deploy geothermal energy to heat and cool their installations in partnership with EERE's Federal Energy Management Program (FEMP).

Energy Efficiency supports RDD&D focused on the resilience of homes and buildings and strengthening U.S. manufacturing competitiveness. Ongoing efforts include the deployment of commercially ready technologies or demonstrations, as well asthe acceleration of innovation to help decarbonize energy-intensive industries, sustainably strengthen the domestic supply chain for critical minerals, and increase energy efficiency and demand flexibility for the 125 million U.S. homes and commercial buildings. Energy Efficiency contributes to a clean energy economy by 2050 through its statutory responsibilities associated with appliance standards and assessment of energy savings from model building codes through the work of the Building Technologies Office. In addition, Energy Efficiency includes significant funding increases for crosscutting programs that include renewable energy deployment through activities such as the State Energy Program (SEP)and the Federal Energy Management Program (FEMP), as well as near term deployment through the Weatherization Assistance Program.

Advanced Manufacturing supports work to improve energy efficiency, reduce carbon emissions of U.S. manufacturers, and enable domestic manufacturers to be competitive in the global marketplace. Industrial processes contribute as much as 20 percent of the Nation's carbon emissions, and the Request includes a substantial increase for industrial decarbonization efforts, including support of industrially relevant RDD&D of emerging zero-carbon technologies for steel,

cement, and chemical manufacturing.

The Request also provides funding to demonstrate with industry partners five commercial production technologies by 2030, and funding to collaborate with the Hydrogen and Fuel Cells Technologies Office on the use of green hydrogen to decarbonize ammonia and steel manufacturing. In addition, the Request includes support for two new Clean Energy Manufacturing Innovation (CEMI) Institutes to support the U.S. manufacturing sector in reducing their energy use intensity and incorporating resiliency systems into their operations. These new manufacturing institutes will be integrated into the growing ManufacturingUSA® network alongside institutes launched by the Department of Defense and the National Institute of Standards and Technology. The Request also supports the eleventh year and re-competition of the Critical Materials Institute, which is dedicated to finding innovative solutions and creating transformational paths to eliminate the criticality of certain rare earth and other elements through the diversification of supplies, development of substitutes, and improvement of usage efficiency, reuse, and recycling.

To ensure the U.S. manufacturing sector is competitive, the Request also includes support to revitalize the U.S manufacturing sector to be agile, resilient, and responsive through a new emphasis on infrastructure for agile manufacturing and support for workforce development activities. This emphasis will promote training and education activities, including within energy communities, with the goal of effectively preparing both the incumbent and future workforce to implement responsible manufacturing.

Federal Energy Management Program (FEMP) helps agencies leverage Federal investment in support of mission assurance goals for resilient, efficient, and secure facilities and operations. The Request includes a significant increase to the Federal Energy Efficiency Fund (FEEF), providing direct funding to Federal agencies for the development of energy and water efficiency projects and processes that address climate change mitigation and/or adaptation. By leveraging the use of privately financed performance contracts, FEMP will accelerate the adoption of energy and water conservation measures, as well as deep building retrofits across the Federal Government.

The Request also increases FEMP technical assistance, guidance, and on-site training across all focus areas to facilitate implementation of energy and water electrification and decarbonization strategies across the Federal Government. This includes funding for technical assistance to transition Federal agencies to carbon-free electricity and for federal fleet electrification across 18 agencies with dedicated FY 2022 resources for purchasing and leasing electric vehicle infrastructure, including procurement and installation of charging infrastructure.

Building Technologies supports investments to reduce the energy intensity of homes and commercial buildings—and thus significantly decarbonize them. To that end, the Request includes increased support for the Advanced Building Construction (ABC) Initiative to enable the U.S. to become a leader in modernized, low-carbon building construction and renovation through RD&D needed to scale highly efficient modular new construction techniques, and develop easy-to-install low-cost advanced retrofit solutions.

The Request also supports the initiation of the E3 Heat Pump Initiative for Better Energy, Emissions, and Equity to accelerate the adoption of grid-interactive heat pump (HP) technologies and deploy strategies and resources to reduce emissions attributed to building equipment, including fossil-fueled equipment and refrigerants.

The Request includes continued support for workforce development activities to 1) expand interest in careers that will enable a low-carbon, modernized U.S. building stock among underrepresented groups; and 2) improve the skills of existing trades and professionals, as well as streamline pathways from education and training to viable careers.

The Request also supports statutory requirements to advance energy and water conservation standards and test procedures for appliances and equipment. DOE is committed to meeting its legislatively mandated deadlines for covered appliances and equipment. Similarly, the Request supports the advancement of building energy codes, including participation in processes to update model energy codes, making a formal determination as to whether new editions increase energy efficiency in residential and commercial buildings, and providing technical assistance to states and local governments to support energy code implementation.

Weatherization and Intergovernmental Programs partners with state and local organizations to significantly accelerate the deployment of clean energy (e.g., energy efficiency, renewable energy, and energy storage) technologies and practices through place-based strategies involving a wide range of government, community, and business stakeholders.

The Request provides $400 million in the Weatherization Assistance Program (WAP) to weatherize at least 50,000 homes per year via formula grants to the 50 U.S. states, Washington, D.C., and five U.S. territories. This funding is a down payment on the Administration's commitment to retrofit two million homes.

In addition, the Request also provides $21 million for the creation of a new Weatherization Readiness Fund to enable more low-income Americans to receive Weatherization Assistance by providing funds to address structural and health and safety issues to reduce the frequency of deferred homes that are not weatherization ready when WAP work crews enter the home to perform retrofit services. A portion of this funding will be targeted at repeat customers of Low-Income Home Energy Assistance Program support.

The State Energy Program (SEP) strategically engages the leadership of states in deploying clean energy technologies across the Nation. SEP funding transforms the energy economy state by state, establishing and implementing clean energy (e.g., energy efficiency, renewable energy, and energy storage) policies, plans, and programs to reduce energy costs, enhance economic competitiveness, improve emergency planning, and improve the environment.

The Request also sustains support ($62.5 million) for the traditional formula-based SEP grants program and launches the Build Back Better Challenge grants program ($300 million) to incubate novel approaches to clean energy technology deployment, prioritizing investments that meet energy needs at the local level, and are inclusive in elevating impoverished and disenfranchised communities, and/or communities that have been marginalized or overburdened.

The Request also provides $25 million to establish the Local Government Clean Energy Workforce Program (LGCEWP)—a new pathway for providing competitive awards, on-site capacity, peer exchanges, and technical assistance to support the development and deployment of transformative clean energy programs that create good paying jobs working with qualifying local governments and Tribal Nations, with a focus on energy communities and disadvantaged or small-to-medium jurisdictions.

Corporate Support Programs support a range of activities to make EERE more efficient and effective. This effort includes support to strengthen EERE's overall performance, organization, budget, laboratory management, operations, human capital, and project management, while achieving significant cost savings. This work includes support for program directionand facilities and infrastructure as part of EERE's stewardship of the National Renewable Energy Laboratory (NREL) in Golden, Colorado.

Facilities and Infrastructure ensures EERE fulfills its role as the steward of NREL and that existing research and support infrastructure are maintained and upgraded in key areas to attract world-class research scientists and to develop innovative solutions to the most challenging technology issues**.** NREL serves as the Nation's preeminent institution for delivering impactful scientific knowledge and technology innovations that transform renewable energy technologies, systems, and markets.

The Request prioritizes increased investments in the Advanced Research in Integrated Energy Systems (ARIES) initiative. The goal of these investments is to address the challenges of designing and constructing future energy systems using the basic principles of operating large-scale hybrid energy systems that interconnect multiple generation and storage technologies. Efforts will be aimed at solving the complex problem of controlling the interactions between millions of distributed assets. These investments will serve the first year of a four-year refresh/upgrade of NREL's High-Performance Computer (HPC).

The Request also supports the Energy Materials and Processing at Scale (EMAPS) line-item construction project, a planned design and construction of a multi-disciplinary research capability in process integration that draws on bench-scale innovations from multiple institutions and transforms them into integrated and scalable hybrid technology processes needed to ready DOE innovations for commercial development.

Program Direction enables EERE to maintain and support a world-class Federal workforce. The Request provides additional resources for program and project management, oversight activities, contract administration, workforce management, IT support, and Headquarters (HQ) and field site non-laboratory facilities and infrastructure. This includes increased staffing and contract support for areas such as appliance standards development and building codes development, FEMP technical assistance to assist agencies in transitioning to carbon-free electricity and fleet electrification, and to support EERE's programmatic priorities.

In addition, the Request includes increased funding for information technology systems development to ensure EERE can collect and analyze data on its investments to make sure every dollar is contributing to mission.

Office of Strategic Programs supports high-impact, crosscutting, integrative activities most efficiently executed by a single crosscutting organization in coordination with EERE technology programs and other DOE offices. This includes support for activities to inform key EERE audiences and stakeholders about the work that EERE is doing to transition the Nation to a clean energy economy and fight the global climate crisis, and funding to address high energy costs, reliability, and inadequate infrastructure challenges faced by islands and remote communities as part of the Energy Transitions Initiative, in partnership with other EERE Technology Offices and other DOE offices.

The Request also includes increased funds for capacity building to support Administration priorities, including support for a new Energy Efficiency and Clean Energy Standard program and an Energy Efficiency Consumer Rebate program pending Congressional authorization, as well as technical assistance associated with funding for electric vehicles and deploying 500,000 charging stations.

($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted	
				$	%
Electricity					
Transmission Reliability and Resilience	57,000	48,220	37,000	-11,220	-23.3%
Resilient Distribution Systems	45,000	50,000	50,000	0	0.0%
Energy Storage	56,000	80,000	119,000	+39,000	+48.8%
Cyber R&D	0	0	25,000	+25,000	N/A
Transformer Resilience and Advanced Components	7,000	7,500	22,500	+15,000	+200.0%
Energy Delivery Grid Operations Technology	0	0	43,500	+43,500	N/A
DCEI Energy Mission Assurance	0	1,000	0	-1,000	-100.0%
Transmission Permitting and Technical Assistance	7,000	7,000	10,000	+3,000	+42.9%
Program Direction	18,000	18,000	20,000	+2,000	+11.1%
Total, Electricity	**190,000**	**211,720**	**327,000**	**+115,280**	**+54.4%**

Appropriation Overview

Grid modernization is critical to achieving public policy and national security objectives, sustaining economic growth, supporting environmental stewardship, promoting energy justice, and mitigating risks to secure the Nation. The Office of Electricity (OE) leads the Department's efforts to strengthen, transform, and improve energy infrastructure so consumers have access to secure and resilient sources of electricity. OE provides solutions to market, institutional, and operational failures that go beyond any one utility's ability to solve.[1] To accomplish this critical mission, OE works with private industry and Federal, State, Tribal, territorial, and regional governments on a variety of initiatives to modernize the electric grid.

Proactive, coordinated, and innovative steps are needed to lay the foundation for economic growth and the creation of good-paying jobs and to ensure benefits accrue to marginalized and overburdened communities while addressing four critical challenges:

- Increasing threats and risks to the security of energy infrastructure
- Changes in demand driven by population growth, adoption of more energy efficient technologies, dynamic economic conditions, and broader electrification
- Changes in the supply mix and location (centralized, distributed, and offshore) of the Nation's generation portfolio
- Increasing variability and uncertainty from both supply and demand, including integration of variable renewables, more active consumer participation, and accommodating new technologies and techniques

Due to the critical role the electric grid plays across Federal, State, Tribal, territorial, and regional jurisdictions, OE programs work in an integrated manner in partnership with industry and other stakeholders, as well as other DOE offices, to enhance key characteristics of the U.S. electric transmission and distribution systems:

- Resilience—the ability to withstand and quickly recover from disruptions and maintain critical function
- Security—the ability to protect system assets and critical functions from unauthorized and undesirable actors
- Reliability—consistent and dependable delivery of high-quality power
- Flexibility—the ability to accommodate changing supply and demand patterns and new technologies
- Affordability—more optimal deployment of assets to meet system needs and minimize costs
- Efficiency—low losses in electricity delivery and more optimal use of system assets

[1] Examples include wide-area visibility, identified from the 2003 Northeast blackout, and faster modeling and analysis, identified in the 2011 Southwest blackout.

- Environmental Justice—addressing disproportionately high and adverse human health, environmental, climate-related, economic, and other cumulative impacts on disadvantaged and energy communities

Within the Request, OE funds:

- Research and Development (R&D)—pursuing research for technologies to improve grid reliability, resilience, efficiency, flexibility, and functionality
- Cybersecurity R&D—design next-generation systems that are built from inception to automatically detect, reject, and withstand cyber incidents, regardless of the threat to the electricity delivery system
- Modeling and Analytics—developing core analytic, assessment, and engineering capabilities that can evolve as the technology and policy needs mature to support decision making within the Department and for stakeholders; analyses explore complex interdependencies among energy infrastructure systems, such as between electricity and natural gas systems
- Data Platforms and advanced communications/control designs—pursuing national-scale sensor, data, and communication architecture platforms to mitigate risk and improve the economic efficiency of grid operations such as improved asset management
- Grid Storage Launchpad—final year of funding for construction of the facility and associated infrastructure to consolidate existing materials research and new characterization and testing capabilities focused on grid scale energy storage research
- Institutional Support and Technical Assistance—building capacity in the industry and convening stakeholders to coordinate efforts to transform the electric grid; providing technical assistance to Federal, State, Tribal, territorial, and regional entities to improve policies, utility incentives, State laws, and programs that facilitate the modernization of the electric infrastructure while also incorporating energy justice principles
- Coordination of Federal Transmission Permits and Transmission Planning—streamlining permits, special use authorizations, and other approvals required under Federal law to site electric transmission facilities
- Coordination with the Power Marketing Administrations to implement R&D solutions

The proposed investment continues to support OE's mission of security and resilience through five key priorities:

- North American Energy Resilience Model: Using the integrated North American Energy Resilience Model (NAERM) developed from 2019–2021 in partnership with the national laboratories and relevant stakeholders, conduct energy planning, transmission planning, and contingency analyses to drive infrastructure investment in the North American energy system
- Grid flexibility through Megawatt-Scale Grid Storage: pursue megawatt-scale storage capable of supporting voltage and frequency regulation, ramping, and energy management for bulk and distribution power systems
- Deep Learning via Sensing Technology Utilization: pursue integration of high-fidelity sensing technology for predictive and correlation modeling for electricity and interdependencies with oil and natural gas (ONG) systems
- Expanding Transmission Capacity and Advanced Grid Architectures: pursue electricity-related policy issues by carrying out statutory and executive requirements, while also providing policy design and analysis expertise to Federal, State, Tribal, territorial, and regional entities
- Building in Cybersecurity as a Standard: Accelerate and expand cybersecurity efforts to strengthen electricity infrastructure against cyber threats while mitigating vulnerabilities

Program Highlights

- **Transmission Reliability and Resilience** is focused on ensuring the reliability and resilience of the U.S. electric grid through R&D on measurement and control of the electricity system, assessing evolving system needs, identifying pathways to achieve an equitable transition to decarbonization and electrification, and risk assessment to address challenges across integrated energy systems. Funding decreases due to the FY 2021 completion of funding for NAERM Phase II development, as well as for fully funded FY 2021 congressionally directed projects for sensors and analytics technologies, a composite utility pole assessment, and the Grid Research Integration and Demo Center, not only account for the overall funding decrease in FY 2022 but also offset growth in Transmission Reliability and Renewable

Integration and Advanced Grid Modeling. NAERM operations and maintenance transitions to the Energy Delivery Grid Operations Technology (EDGOT) program in FY 2022.

- **Resilient Distribution Systems** develops transformative technologies, tools, and techniques to enable industry to modernize the distribution portion of the electric delivery system. The FY 2022 request supports a competitive award to harness emerging sources of energy for balance, reliability, and control: EVs, connected homes and buildings, increasing distributed solar, and energy storage. Situational Awareness Network (SAN) activities, which relate to operational support, maintenance, and expansion, transition to EDGOT.

- **Energy Storage** is designed to develop new and advanced technologies that will ensure the reliability, resilience, and flexibility of electricity infrastructure. The request supports technology development of novel materials and system components, building a safety and reliability knowledge base for energy storage systems and components, and developing open-source analytic tools to address issues such as energy storage planning, sizing, placement, valuation, and societal and environmental impacts. The OE Grid Storage Launchpad (GSL) project, which is aimed at accelerating materials development, testing, and independent evaluation of battery materials and battery systems for grid applications, is fully funded in FY 2022 through the completion of construction and commissioning of the facility.

- **Cyber R&D** is a new activity for OE in FY 2022 that was previously supported by the Office of Cybersecurity, Energy Security, and Emergency Response (CESER). It addresses R&D for energy sector cybersecurity associated with electricity delivery systems. Cyber R&D will focus on data and physics to redesign grid architecture that exposes the electricity system to cyber threats and will pursue coordinated engagement with DOE's other cyber-related activities, including in CESER and the Office of Intelligence and Counterintelligence. An important part of the Cyber R&D portfolio will be academic R&D for technology-focused activities that, in combination with industry guidance, result in impactful real-world solutions while helping train and develop the next generation of cybersecurity specialists.

- **Transformer Resilience and Advanced Components** develops grid hardware innovations that carry, control, and convert electricity, helping achieve decarbonization goals, ensure reliability and resilience of electric infrastructure, adapt the electricity delivery system to the evolution of the electric power grid, and provide the foundation to invigorate domestic transformer manufacturing. The FY 2022 request accelerates the timeline for field validation of innovative, flexible, and adaptable prototypes for large power transformers (LPTs), which will promote greater standardization to increase grid resilience. Integrating of sensors and data analytics (such as for health monitoring) can further enhance the flexibility and adaptability of LPTs. TRAC will also address critical research needs for solid-state power substations (SSPS) with an emphasis on advanced materials, embedded intelligence for equipment monitoring, and validation of prototype converter building blocks.

- **Energy Delivery Grid Operations Technology** is a new program in OE in FY 2022 that includes operations and maintenance for NAERM, which was developed by Transmission Reliability and Resilience (TRR), as well as the Post-Event Analysis Coordination (PEAC) network and Situational Awareness Network (SAN), which were previously supported by TRR and Resilient Distribution Systems, respectively. EDGOT will support a public–private partnership to develop national-scale energy planning and real-time situational awareness capabilities by focusing on developing large, networked communication and data infrastructures across multiple utility boundaries. The core of the EDGOT portfolio is NAERM, which will help us transition from the current reactive state-of-practice to a new energy planning, investment, and operations paradigm in which we proactively develop infrastructure investment strategies. The EDGOT technology portfolio will enable assessment of risks and uncertainty, evaluation and identification of effective mitigation strategies, and support of more informed infrastructure planning and investment decisions by both public and private sectors, thereby enhancing U.S. energy and economic security. In FY 2022, leveraging NAERM capabilities, EDGOT will develop the framework and layers for an EDS infrastructure grid planning tool for transmission and distribution level networks supporting short- and long-term planning of grid activities.

- **Defense Critical Electric Infrastructure (DCEI) Energy Mission Assurance** was established in FY 2021 to identify, evaluate, prioritize, and assist in developing executable strategies to ensure that critical national defense and security missions have reliable access to power as energy supply disruptions threaten the civilian grid due to intensifying cybersecurity threats as well as other hazards. In FY 2022, DOE is proposing to integrate the functions of the DCEI Energy Mission Assurance program into CESER's suite of activities partnering with, supporting, and sharing information with the electric utility industry to enhance energy resilience through its energy assurance planning efforts.

- **Transmission Permitting and Technical Assistance** works with electricity system partners and stakeholders to modernize the grid and ensure equitable and adequate transmission capacity across the United States. The FY 2022 request expands TPTA's outreach and support activities with Federal, State, and industry partners to address the climate

crisis by decarbonizing the electricity sector, transmission planning, and maximizing cost-effective demand-side resources and solutions to achieve 100% carbon-free electricity by 2035.

($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted	
				$	%
Power Marketing Administrations					
Southeastern Power Administration					
Southeastern Power Administration	77,301	77,409	95,623	+18,214	+24.0%
Less Alternative Financing/Offsetting Collections	-77,301	-77,409	-95,623	-18,214	-24.0%
Total, Southeastern Power Administration	**0**	**0**	**0**	**0**	**N/A**
Southwestern Power Administration					
Southwestern Power Administration	131,863	116,194	156,816	40,622	35.0%
Less Alternative Financing/Offsetting Collections	-121,463	-105,794	-146,416	-40,622	-38.4%
Total, Southwestern Power Administration	**10,400**	**10,400**	**10,400**	**0**	**N/A**
Western Area Power Administration					
Western Area Power Administration (CROM)					
Western Area Power Administration (CROM)	883,923	843,590	974,091	+130,501	+15%
Less Alternative Financing/Offsetting Collections (CROM)	-789,551	-739,218	-883,319	-144,101	-19%
Rescission of Prior Year Balances	-176	0	0	0	0%
Use of Prior Year Balances	-5,000	-15,000	0	-15,000	-100.0%
Total, Western Area Power Administration (CROM)	**89,196**	**89,372**	**90,772**	**+1,400**	**+2%**
Falcon and Amistad O&M Fund					
Operation and Maintenance	5,647	7,302	7,545	+243	+3%
Less Alternative Financing/Offsetting Collections	-4,119	-7,074	-7,317	-243	-3%
Use of Prior Year Balances	-1,300	0	0	0	0%
Total, Falcon and Amistad O&M Fund	**228**	**228**	**228**	**0**	**0%**
Colorado River Basins Power Marketing Fund					
Spending Authority from Offsetting Collections	220,224	245,047	237,290	7,757	3%
Offsetting Collections	-241,644	-266,447	-258,690	-7,757	-3%
Total, Colorado River Basins Power Marketing Fund	**-21,400**	**-21,400**	**-21,400**	**0**	**0%**
Total, Western Area Power Administration	**68,024**	**68,200**	**69,600**	**+1,400**	**+2%**
Total, Power Marketing Administrations	**78,424**	**78,600**	**80,000**	**+1,400**	**+2%**

Appropriations Overview

The four **Power Marketing Administrations (PMAs)** sell electricity primarily generated by federally owned hydropower projects. Preference in the sale of power is given to public entities and electric cooperatives. Revenues from the sale of Federal power and transmission services are used to repay all related power and transmission costs.

Program Highlights

- **Southeastern Power Administration**
  Southeastern markets and delivers all available Federal hydroelectric power from 22 U.S. Army Corps of Engineers (Corps) multipurpose projects to preference customers in an eleven-state area in the southeastern United States. Southeastern does not own or operate any transmission facilities, and contracts with regional utilities that own electric transmission systems to deliver the Federal hydropower to Southeastern's customers. Southeastern's use of receipts and alternative financing offsets its appropriations resulting in a net-zero balance for the program.

- **Southwestern Power Administration**
  Southwestern markets and delivers Federal hydroelectric power from 24 Corps multipurpose projects to preference customers in a six-state area and participates with other water resource users in an effort to balance diverse interests with power needs. To deliver power to its customers, Southwestern maintains 1,380 miles of high-voltage transmission lines, 26 substations/switchyards, and 51 microwave and VHF radio sites. To maintain the infrastructure and modernize systems to increase the reliability, efficiency, and use of Federal assets, Southwestern utilizes appropriations, Federal power receipts, and alternative financing. Of these, 93.0% is derived from use of receipts and alternative financing, resulting in a net appropriation of only 7.0%.

- **Western Area Power Administration**
  Western Area Power Administration (WAPA) markets and transmits Federal power to a 1.3-million-square-mile service area in 15 central and western states from 57 Federally-owned hydroelectric power plants operated by the Bureau of Reclamation (the Bureau), the Army Corps of Engineers (the Corps), and the International Boundary and Water Commission. WAPA's construction program, conducted in close coordination with preference customers, continues to emphasize replacement, upgrade, and modernization of the electric system infrastructure to bring continued reliability, improved connectivity, and increased flexibility and capability to the power grid. Through extensive partnering efforts, WAPA has obtained significant stakeholder and customer participation in financing much of the construction program. Through transparency WAPA demonstrates the value of its efficient operations that preference customers enjoy. WAPA will continue to make significant efforts to be open, transparent and inclusive of customers and stakeholders in its operational choices and capital planning efforts. WAPA is strengthening its Asset and Risk Management to further ensure capital investments are sufficient and wisely deployed for our Nation and for our customers.

- **Bonneville Power Administration**
  Bonneville operates under a business-type budget under the Government Corporation Control Act, 31 U.S.C 9101-10 and on the basis of the self-financing authority provided by the Federal Columbia River Transmission System Act of 1974 (Transmission Act) (Public Law 93-454).

  Bonneville is responsible for meeting the net firm power requirements of requesting customers through a variety of means, including energy conservation programs, acquisition of renewable and other resources, and power exchanges with utilities both in and outside the region.

  Bonneville provides electric power, transmission, and energy services to a 300,000-square-mile service area in eight states in the Pacific Northwest. Bonneville wholesales the power produced at 31 Federal projects operated by the Corps and the Bureau and from certain non-Federal generating facilities. Bonneville operates and maintains over 15,000 circuit-miles of high voltage transmission lines and 261 substations. From these revenues, Bonneville funds the expense portion of its budget and the power operations and maintenance costs of the Bureau and the Corps in the Federal Columbia River Power System (FCRPS). The capital portion of the budget is funded primarily through borrowing from the U.S. Treasury at market rates for similar projects and with some non-Federal financing.

  Bonneville is self-financed and receives no direct annual appropriations from Congress. In FY 2022, estimated total requirements of all Bonneville programs of $4,312 million include estimated budget obligations of $3,616 million and estimated capital transfers of $696 million. Estimated obligations include operating expenses of $2,734 million, capital investments of $826 million, and $56 million in projects funded in advance. These investments provide electric utility

and general plant requirements associated with the FCRPS's transmission services, capital equipment, hydroelectric projects, conservation, and capital investments to mitigate impacts on the environment, fish, and wildlife.

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted	
				$	%
Cybersecurity, Energy Security, and Emergency Response					
Risk Management Tools formerly – (Cybersecurity for Energy Delivery Systems)	95,000	96,000	135,000	39,000	41%
Infrastructure Security and Energy Restoration	48,000	48,000	0	(48,000)	(100%)
Response and Restoration			25,000	25,000	100%
Information Sharing, Partnerships and Exercises			25,000	25,000	100%
Program Direction	13,000	12,000	16,000	4,000	33%
Total, Cybersecurity, Energy Security, and Emergency Response	**156,000**	**156,000**	**201,000**	**45,000**	**29%**

Appropriation Overview

Cybersecurity, Energy Security, and Emergency Response (CESER) leads the Department's efforts to secure U.S. energy infrastructure against all hazards, reduce the risks of and impacts from cyber events and other disruptive events, and assist with restoration activities. CESER is the Office responsible for DOE's responsibilities as lead agency for Emergency Support Function #12 (Energy), or ESF #12, under the National Response Framework, and is the Energy Sector Risk Management Agency (SRMA) for national efforts to enhance preparedness, resiliency, and recovery of the U.S. energy infrastructure from all threats and hazards.

The energy sector plays a critical role across Federal, State, and local jurisdictions and with nearly all other critical infrastructures relying on the power and fuel to operate. CESER programs work in an integrated manner with industry, state, and federal partnerships to enhance the resilience--the ability to withstand, maintain critical function and quickly recover from disruptions---and security --the ability to reduce risks in the protection system assets and critical functions from unauthorized access and actions --of the U.S. energy infrastructure for all consumers, in line with clean energy and energy justice principles. Secure and resilient energy infrastructure is critical to U.S. economic competitiveness, innovation, and leadership and must be considered with equity and energy justice as priorities.

The FY 2022 Budget Request also proposes that the Office of Petroleum Reserves will soon be shifted to report to the Assistant Secretary for CESER in order to align the Department's non-nuclear emergency management and national security functions; no change in the appropriations request is needed for this move.

Within the appropriation, CESER funds:

- Develop and deliver game-changing tools and technologies to help utilities secure and reduce risks to todays' energy infrastructure from advanced cyber threats and design next-generation systems that are built from inception to automatically detect, reject, and withstand cyber incidents, regardless of the threat. As the U.S. moves to a carbon-pollution free energy sector by 2035, CESER will stand ready to develop, deploy, and operationalize tools and technologies to better secure the grid against threats to the evolving grid, from distributed generation to electric vehicles.
- Public and private-sector partnerships which strengthen the energy sector's cybersecurity posture, leveraging DOE-supported tools, guidelines, outreach, training, and technical assistance. CESER will ensure that all communities have equitable access to this support.
- Emergency preparedness and response, supporting the energy sector, to pursue enhancements to national efforts, in cooperation with public and private-sector stakeholders, for preparedness, resilience, and recovery of U.S. energy infrastructure from all threats and hazards.

- CESER will transition the bulk of its cyber research and development portfolio to the Office of Electricity. This shift will allow CESER to expand its risk management tools and technologies focus across all risks and hazards, as well as on cyber risks. Also, the work will tackle significant issues in the sector related to supply chain threats, the rapid modernization of the grid, and additional connectivity due to broader distributed energy resources and electric vehicles. Finally, there is a strong focus on developing cyber visibility in the industrial control system (ICS) environment due to significantly increased cyber threat in that space.

Program Highlights

- **Risk Management Tools (RMT)** seeks to accelerate and expand efforts to strengthen the energy infrastructure against cyber threats and mitigate vulnerabilities. As the Sector Risk Management Agency (SRMA) for Energy, DOE will invest in threat and vulnerability situational awareness tools and capabilities to develop and maintain sector-wide situational awareness of cyber and physical/natural hazards and emerging trends focused on energy sector disruption and leverage DOE partnerships with energy sector industry, other federal agencies such as the Department of Homeland Security, and state, local, and tribal governments. RMT will enable maintenance of real-time sector-wide situational awareness combined with time-sensitive analysis, visualization, and dissemination of actionable threat and vulnerability information in support of key DOE, federal government, and energy sector stakeholders. These tools will incorporate rapid dissemination and processing of energy sector data for identification and characterization of threats for intelligence analysis, assessments, products, and services in unclassified and classified environments required to support CESER's operational cyber and energy security responsibilities. These specialized tools will use analytics to understand, enrich, and fuse data and enable intelligence-driven action to improve resilience for the energy sector. Working closely with the energy sector and our government partners, the request focuses on enhancing the speed and effectiveness of threat and vulnerability information sharing. including bi-directional machine-to-machine information sharing, and accelerating game-changing tools to mitigate cyber incidents in today's systems and to develop next-generation resilient energy delivery systems while developing analyses to quantify the resulting relative risk reduction. The request also supports continuing our efforts in support of a national physical energy system and component testing capability designed specifically to look at the vulnerabilities of the energy sector from threats such as Electro-Magnetic Pulse (EMP) and Geo-Magnetic Disturbance (GMD).

- **Response and Restoration (R & R)** coordinates a national effort to secure U.S. energy infrastructure against all hazards, reduce impacts from disruptive events, and assist industry with restoration activities. During incidents requiring a coordinated federal response the Response and Recovery program activates the Energy Response Organization (ERO) to manage Emergency Support Function (ESF) #12 andSRMA activities to include deployment of responders and sector engagement. As the lead for ESF #12 CESER works with partners to assess the impacts of disasters on local and regional energy infrastructure; to provide situational awareness updates to Federal, state, and private sector partners; to facilitate legal and regulatory waivers to accelerate restoration of damaged energy systems; and to provide technical expertise on energy damage assessment, restoration and logistical assistance. To fulfill the Department's ESF #12 responsibilities, CESER trains and coordinates a cadre of volunteer ESF #12 responders across DOE. When activated ESF #12 DOE deploys responders to FEMA National and Regional Response Coordination Centers, FEMA Joint Field Offices and/or State Emergency Operations Centers. Each FEMA Region is represented by an ESF #12 Regional Coordinator who maintains regular contact to support planning efforts with regional and state counterparts. Catastrophic and incidents in remote locations are managed by the ESF #12 Catastrophic Incident Response Team (CIRT), a subset of ESF #12 responders. CIRT delivers critical capabilities including energy sector emergency response and recovery (including emergency response of a cyber nature); near-real-time situational awareness and information sharing about the status of the energy systems to improve risk management; analysis of evolving threats and hazards to energy infrastructure; and technical assistance that incorporates exercises in order to strengthen Federal, Regional, State, Local, Tribal, and Territorial (SLTT) abilities to work together to prepare for and mitigate the effects of an energy sector emergency. By working with the SLTT energy community to plan and develop mitigations the Nation's energy systems will become more secure and resilient.

- **Information Sharing Partnerships and Exercises (ISPE)** supports energy sector security and resilience through coordination with government and industry partners. The ISPE program advances the Department's efforts to support SLTT and industry in preparing for, mitigating, and recovering from all threats and hazards facing the U.S. energy sector. ISPE achieves this through information sharing, risk assessments, capacity building in planning and resilience, and targeted training and exercises. This budget request is focused on the Administration's priorities for combating climate change, creating clean energy jobs and promoting energy justice. Activities include studies of economically disadvantaged communities for response and recovery, the vulnerability of energy assets, and workforce development. Additionally, ISPE will focus on training the next generation workforce on energy sector risks and developing a cyber educated workforce will be an overall emphasis in both Planning, Preparedness and Resilience and Exercises and Training activities, helping to create good paying jobs with a free and fair chance to join a union and collectively bargain.

($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted	
				$	%
Cybersecurity, Energy Security, and Emergency Response Petroleum Accounts					
Naval Petroleum and Oil Shale Reserves					
Production Operations	12,000	11,000	11,650	+650	+5.9%
Management	2,000	2,006	2,000	-6	-0.3%
Total, Naval Petroleum and Oil Shale Reserves	**14,000**	**13,006**	**13,650**	**+644**	**+5.0%**
Strategic Petroleum Reserve					
Facilities Development and Operations	168,235	160,949	168,525	+7,576	+4.7%
Management for SPR Operations	26,765	27,051	28,475	+1,424	+5.3%
Northeast Gasoline Supply Reserve	0	0	0	0	0
Total, Strategic Petroleum Reserve	**195,000**	**188,000**	**197,000**	**+9,000**	**+4.8%**
Northeast Home Heating Oil Reserve					
Northeast Home Heating Oil Reserve	10,000	6,500	0	-6,500	-100%
Total, Northeast Home Heating Oil Reserve	**10,000**	**6,500**	**0**	**-6,500**	**-100%**
SPR Petroleum Account					
SPR Petroleum Account	10,000	1,000	7,350	+6,350	+635%
Total, SPR Petroleum Account	**10,000**	**1,000**	**7,350**	**+6,350**	**+635%**
Total, CESER Petroleum Accounts	**229,000**	**208,506**	**218,000**	**+9,494**	**+4.6%**
Energy Security & Infrastructure Modernization Fund	**450,000**	**0**	**0**	**0**	**0**

Appropriation Overview

The Office of Cybersecurity, Energy Security, and Emergency Response (CESER) Petroleum Accounts consist of emergency petroleum security/supply programs, a Strategic Petroleum (SPR) modernization program, and post-sale remediation activities at the Naval Petroleum Reserve Oil Shale Reserves (NPOSR) Nos. 1 and 3. The SPR storage sites are located at four government-owned Gulf Coast locations with oversight from the Project Management Office in Harahan, Louisiana, and Headquarters in Washington, D.C. Both the Northeast Home Heating Oil Reserve (NEHHOR) and the Northeast Gasoline Supply Reserve (NGSR) consist of Government-owned refined petroleum products stored in leased commercial storage in terminals in the Northeast. Legacy environmental clean-up/remediation continues at the previously-sold NPOSR No. 1 (Elk Hills, CA), and landfill monitoring and closure continues as part of post-sale activities at NPOSR No. 3 (Casper, WY).

Program Highlights

- **Strategic Petroleum Reserve**
  The Strategic Petroleum Reserve (SPR) Program provides strategic and economic security against foreign and domestic disruptions in oil supplies via an emergency stockpile of crude oil. The program fulfills United States' obligations under the International Energy Program, which avails the U.S. of International Energy Agency assistance through its coordinated energy emergency response plans and provides a deterrent against energy supply disruptions. The SPR Program will perform sustainment and construction activities, as well as cavern wellbore testing and remediation activities to ensure the availability of the SPR's crude oil inventory.
  -

- **SPR Petroleum Account**
  The SPR Petroleum Account Program funds SPR petroleum acquisition, transportation, and drawdown activities. The Department is requesting authorization to deposit into the SPR Petroleum Account any appropriated funds received, which will be used as a source of funding for drawdown costs related to Congressionally-directed, multi-year sales of crude oil from the SPR and for any fill operations.

- **Naval Petroleum and Oil Shale Reserves**
  Following the 1998 sale of the Government's interests in the NPOSR-1 (Elk Hills, CA), environmental cleanup/remediation activities under the Corrective Action Consent Agreement with the State of California Department of Toxic Substances Control (DTSC) began. Of the 131 areas of concern (AOCs) for which DOE is responsible for environmental cleanup, as of March 2021, 111 AOCs have received no further action (NFA) certification from California's DTSC. The remaining 20 AOCs require remediation.

- **Northeast Home Heating Oil Reserve**
  The FY 2022 President's Budget requests no appropriation for the Northeast Home Heating Oil Reserve.

- **Energy Security and Infrastructure Modernization Fund**
  The FY 2022 President's Budget requests no appropriation for the Energy Security and Infrastructure Modernization Fund (ESIM or the Fund). The ESIM fund was established in Section 404 of the Bipartisan Budget Act of 2015 to finance modernization of the SPR. Sales of SPR crude oil will be used to fund the completion of the Life Extension Phase II (LE2) project needed to ensure the SPR can maintain its operational readiness capability, meet its mission requirements, and operate in an environmentally responsible manner. The CARES Act (Pub. L. 116-136, Section 14002) provided the Department flexibility to conduct the final sale into FY 2022 to raise funding for the SPR Modernization Program, in accordance with Section 404 of the Bipartisan Budget Act of 2015 (Pub. L. 114-74). As a result, Section 404 sales of SPR oil will likely be conducted in FY 2021.

($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted	
				$	%
Carbon Capture, Utilization and Storage (CCUS) and Power Systems					
Carbon Capture	97,800	86,300	150,000	63,700	73.8%
Carbon Utilization	21,000	23,000	38,000	15,000	65.2%
Carbon Storage	79,000	79,000	117,000	38,000	48.1%
Advanced Energy and Hydrogen Systems	111,000	108,100	82,000	-26,100	-24.1%
Crosscutting Research	35,000	32,900	36,500	3,600	10.9%
Carbon Dioxide Removal	20,000	40,000	63,000	23,000	57.5%
Mineral Sustainability	53,000	53,000	45,000	-8,000	-15.1%
Transformational Coal Pilots	20,000	10,000	-	-10,000	-100.0%
Supercritical Transformational Electric Power (STEP)	16,000	14,500	-	-14,500	-100.0%
Subtotal, CCUS and Power Systems	**452,800**	**446,800**	**531,500**	**84,700**	**19.0%**
Natural Gas Technologies	**51,000**	**57,000**	**130,000**	**73,000**	**128.1%**
Unconventional Fossil Energy Technologies from Petroleum - Oil Technologies	**46,000**	**46,000**	**-**	**-46,000**	**-100.0%**
Special Recruitment	**700**	**700**	**700**	**0**	**0.0%**
Program Direction	**61,500**	**61,500**	**66,800**	**5,300**	**8.6%**
NETL Infrastructure	**55,000**	**55,000**	**78,000**	**23,000**	**41.8%**
NETL Research and Operations	**83,000**	**83,000**	**83,000**	**-**	**0.0%**
Total, Fossil Energy and Carbon Management Research & Development, Demonstration, and Deployment	**750,000**	**750,000**	**890,000**	**+140,000**	**18.7%**

Appropriation Overview

The Fossil Energy and Carbon Management (FECM) Research, Development, Demonstration, and Deployment (RDD&D) program conducts research that focuses on early-stage technologies that help to ensure clean and affordable energy for all Americans, facilitate the transition towards a carbon-pollution-free economy, rebuild a U.S. critical minerals (CM) supply chain, and retain and create good paying jobs with a free and fair chance to join a union and collectively bargain. To meet these challenges, the Budget re-focuses funding from traditional fossil combustion-centric activities (e.g. Advanced Energy Systems and Cross-cutting Research) to climate-centric activities (e.g. Carbon Capture, Utilization, and Storage). These reallocations will enable near-term work to develop and deploy carbon solutions for the power and industrial sectors. Immediate action will be taken to locate and mitigate methane leaks, one of the most potent greenhouse gases – coupled with longer term R&D to expedite the hydrogen (H_2) energy economy. These investments will be critical to meet 100% clean electricity by 2035. Carbon dioxide removal (CDR) will be an important tool to achieve net-zero emissions economy-wide by 2050. FECM is investing in direct air capture (DAC), carbon capture and storage (CCS) coupled to the conversion of biomass waste to energy, and accelerated weathering through mineral carbonation to assist in meeting our climate goals.

The FY 2022 Budget Request for FECM will extend the impact of the Department of Energy's (DOE) RDD&D funding by leveraging creative funding mechanisms - such as prizes, competitions, technical assistance, and programs targeted to small businesses. The goal is to enable the commercialization of climate change and clean energy innovations that will activate job creation, expand other public impact outcomes, and yield a more geographically diverse and impactful research portfolio. This request also includes funding for the basic operating costs of FECM and investment at the National Energy Technology Laboratory (NETL).

FECM's FY 2022 RDD&D priorities follow:

- **Reduce Methane Emissions:** Develop technologies and deploy regional initiatives to monitor and reduce methane emissions across the fossil fuel infrastructure including coal, oil, and gas. Specifically, develop advanced sensor

technologies to detect and locate emissions from pipelines, storage facilities, and abandoned mines and wells; novel technologies in advanced materials, sensors, data management tools, in-pipe inspection and repair, and dynamic compressors; and, add RDD&D for advanced modular technologies to beneficially utilize otherwise flared, vented, or stranded natural gas.

- **Accelerate Zero-Carbon and Carbon-Neutral Hydrogen (H_2):** Develop technologies that leverage the natural gas infrastructure for H_2 production, transportation, storage, and use coupled to carbon management. Hydrogen offers an emissions-free fuel for power generation, industrial applications, and the transportation sector.
- **Develop Low-Carbon Supply Chains for Industries:** Develop novel approaches to recycle carbon oxide emissions, principally carbon dioxide (CO_2), into value-added products such as cement, concrete, steel, chemicals, and fuels using systems-based carbon management approaches.
- **Advance Carbon Dioxide Removal:** Research, develop, and demonstrate CDR technologies and approaches by investing in DAC and mineral carbonation projects.
- **Invest in Thoughtful Transition Strategies:** Invest in technologies and approaches and deploy regional initiative to help in the transition to a net-zero carbon economy in coal and fossil-based power plant communities. These approaches such as co-firing fossil fuels with waste biomass, coupled to carbon capture, in addition to mineral and carbon extraction from coal, using safe and sustainable technologies, will leverage both regional resources and existing labor forces to achieve a clean energy economy.
- **Demonstrate and Deploy Point Source Carbon Capture and Storage:** RDD&D for CCS in the power and industrial sectors to enable wider, strategic commercial deployment to meet net-zero emissions goals by 2050.
- **Advance Critical Minerals, Rare Earth Elements (REE), Coal Waste to Products and Mine Remediation:** Develop technologies that enable the sustainable recovery of CM, including REE from multiple feed stocks, throughout the upstream, midstream, and downstream supply chain from carbon and other ores, mining by-products, abandoned mines and wells and other valuable sources. Specifically, develop technologies that improve REE separation/recovery technologies to manufacture products from carbon ore and to address current market and process economics. Develop technologies and validation approaches- including machine learning and artificial intelligence, small- and large-scale pilot projects, and public-private partnerships as well as existing basin partnerships developed through Carbon Ore Rare Earth-Critical Mineral Initiative (CORE-CM).
- **Increase Efficient Use of Big Data and Artificial Intelligence (AI):** Use AI, machine learning (ML), and data analysis to create learning algorithms within large datasets to help discover new materials, optimize processes, and run autonomous systems. Specifically, research passive sensor platforms, data management and systems, and tools that employ AI to help adapt varying hydrogen pipeline conditions, optimize dedicated CO_2 storage, and apply remediation technologies to detect and fix methane leakage from fossil infrastructure. Partner with academic institutions and DOE National Laboratories to focus on the application of AI and ML to improve plant operations, technology testing, systems analysis, and technology transfer to industry.
- **Address the Energy Water Nexus:** Improve the Department's efficient use of scarce water resources and focus on environmental benefits related to advance water remediation technologies associated with produced or displaced water associated with oil, gas, and coal industries, in addition to that associated with dedicated CO_2 storage.

Program Highlights

Carbon Capture, Utilization and Storage (CCUS) and Power Systems. Descriptions of major funding and programmatic changes and highlights within the CCUS and Power Systems program for the FY 2022 Budget Request are as follows:

Carbon Capture. The Carbon Capture activity has completed its efforts in first-generation technology through successful demonstration projects. FY 2022 activities represent a focus on new capture technologies in addition to the demonstration of more proven capture approaches. The FY 2022 Budget Request provides $150 million in the Carbon Capture subprogram for pre- and post-combustion capture RDD&D on transformational gas separation technologies that can help achieve decarbonization goals.

Additionally, the Carbon Capture subprogram will leverage its prior and current RDD&D experience on carbon capture technology development for application to industrial applications. RDD&D will focus on optimization of technologies for these applications to reduce cost and improve performance.

Carbon Utilization. In FY 2022, the Budget Request provides $38 million in the Carbon Utilization subprogram for early-stage CO_2 utilization technologies that have the potential to develop additional markets for CO_2 based-products. Areas of research include, but are not limited to, new projects focused on the catalytic conversion to higher value products such as fuels, chemicals, polymers, and nutraceuticals; mineralization to building products; generation of solid carbon products; and algal systems designed to integrate CO_2. Specific focus on catalysts made from low-cost materials and improved reactor designs will be pursued to lower the energy penalty and capital cost of the conversion process. Funding will support the development of at least one, fully integrated field-test system as well as continued support for carbon utilization test facilities at the National Carbon Capture Center, located in Wilsonville, Alabama.

Carbon Storage. The FY 2022 Budget Request provides $117 million for the Carbon Storage subprogram and RDD&D activities that address the performance challenges of operating and monitoring commercial scale CO_2 storage sites. The RDD&D supported by the Carbon Storage subprogram will aim to improve storage and operational efficiency, improve understanding of overall cost and de-risking strategies to reduce it. Achieving each of these elements is critical for enabling a CCUS industry that is safe, economically viable, and environmentally benign.

Advanced Energy and Hydrogen Systems. The Advanced Energy and Hydrogen Systems subprogram comprises of four activities: (1) Gasification Systems, (2) Advanced Turbines, (3) Reversible Solid Oxide Fuel Cells (R-SOFCs); and (4) Advanced Energy Materials. In FY 2022, these activities will provide research a platform for developing the advanced systems of the future while reducing emissions. In FY 2022, the program will not fund RDD&D specific to traditional fossil power generation, but rather, will narrow the focus to work on hydrogen-fueled turbines, fuel cells, CCUS-relevant technologies, and production of clean hydrogen through gasification. Improvements to these technologies are also applicable to other energy systems. These improvements to new and existing plants will also make them less carbon intensive and allow these assets to provide continued low-cost baseload power and resilient flexible grid services. This subprogram aligns with the Administration's priority to reduce the environmental impact of the power sector, especially regarding disadvantaged communities.

Note: Funding for Gasification Systems to enable hydrogen production is increasing by $29 million (+152.6%) to $48 million. Decreases in this program are for R-SOFCs, where significant work has already taken place, and Transformative Power Generation, which was focused on fossil fuel promotion that are no longer in line with the Administration's goals. There is additional work on hydrogen in the Natural Gas Technologies program.

Crosscutting Research. The Crosscutting Research subprogram supports innovative early stage RDD&D for improving reliability, availability, efficiency, and environmental performance. In FY 2022, the program will not fund RDD&D specific to traditional fossil combustion. Rather, the program will narrow focus to technologies that aid in minimizing the environmental impact of the U.S.'s high dependence on fossil fuels, which includes both power and industrial sectors. The subprogram bridges basic and applied research by targeting concepts with the greatest potential for transformational breakthroughs. Research is focused on seven activities: 1) Sensors, Controls, and Other Novel Concepts; 2) Water Management RDD&D; 3.) Simulation Based Engineering; 4) Energy Analyses; 5) University Training and Research (UTR), which comprises funding for University Coal Research (UCR), Historically Black Colleges and Universities (HBCU) and other Minority Serving Institutions (MSI); 6) International Activities; and 7) Energy Storage Grand Challenge.

Carbon Dioxide Removal (New Control Point). Many modeling scenarios to achieve economy-wide decarbonization suggests that CDR will be required in the future. CDR refers to approaches that remove CO_2 from the atmosphere and store it in geologic formations, products, terrestrial sinks, or in the ocean. CDR activities include DAC, bioenergy with carbon capture and storage (BECCS), mineralization, terrestrial carbon removal and sequestration (e.g., improved forest management, afforestation, reforestation), and coastal blue carbon (e.g., CO_2 storage in wetlands). FECM has focused on the chemical and mineral-based CDR approaches, which was previously funded under the Carbon Capture Program. It builds upon past CCUS efforts which have been funded through FECM's CCUS programs, such as past work on DAC mineralization, co-firing of biomass, and capture technology development.

Note: The CDR subprogram is a new budget line in the FY 2022 Budget Request.

Mineral Sustainability (New Control Point). The Mineral Sustainability subprogram will support domestic supply chain networks required for the economically, environmentally, and geopolitical sustainable production of CM. The integration of

extraction of carbon ore and CM is naturally part of the upstream process; therefore, the integration of the CM and Carbon Ore Processing activities will result in more efficient and economic technology development and deployment. This mission will be accomplished by prioritizing the use of unconventional resources such as coal waste and by-products from industry feedstocks for domestic CM, REE and carbon ore to products production.

Carbon Ore Processing: The Carbon Ore Processing activity (formally Advanced Coal Processing) is focused on utilizing materials to be recycled from previously mined resources outside of traditional thermal and metallurgical markets that can contribute to the U.S. gross domestic product. The activity is focused on developing transformational technologies to enable domestic manufacturing of strategic materials and superior building products from carbon ore at competitive market prices. These transformational technologies have minimal emissions, superior product performance, and better lifecycle for new and existing products in the market.

Note: The Mineral Sustainability subprogram is a new budget line in the FY 2022 Budget Request. CM funding is increasing by $10 million (+43.5%) to $33 million, and carbon ore processing is decreasing by $18 million (-60%) to $12 million. In addition, mineralization activities associated with CO_2 as a feedstock will take place in Carbon Storage and CDR programs.

Natural Gas Technologies. The Natural Gas Technologies Program addresses critical issues associated with the production and transmission of domestic natural gas. Specifically, the Program's mission is to conduct RDD&D that reduces the environmental impact from the development, transportation, distribution, and storage of natural gas resources.

The Environmentally Prudent Development subprogram will focus on addressing the environmental impacts from oil and natural gas development, to include unconventional development and offshore safety and spill prevention. The subprogram will build on research conducted and data collected from the 17 Field Laboratory projects to inform future research. Research includes wellbore integrity, oil spill prevention, and produced water treatment and reuse technologies.

The Emissions Mitigation from Midstream Infrastructure subprogram will develop technologies to reduce emissions from natural gas transmission, distribution, and storage facilities. This includes advanced materials, sensors, data management systems, and more efficient and flexible compressors. The subprogram will develop advanced modular technologies, capable of being deployed near wellheads and natural gas processing and transportation infrastructure, for the purpose of beneficially utilizing otherwise flared, vented, or stranded natural gas. It will also develop advanced sensor technologies to detect and locate emissions from pipelines, storage facilities, and abandoned wells and will develop modular technologies, materials, and solutions to aid in the remediation of orphaned wells.

The Emissions Quantification from Natural Gas Infrastructure subprogram will focus on developing technologies to detect, locate, and measure emissions. This includes the development and validation of measurement sensor technologies for the collection, dissemination, and analysis of emissions data which will inform efforts such as the Environmental Protection Agency's (EPA) Greenhouse Gas Inventory and orphan well remediation programs.

The new Natural Gas Hydrogen Research subprogram will focus on technologies for carbon-neutral hydrogen production as well as hydrogen (and ammonia) transportation, and geologic storage technologies that leverage existing natural gas infrastructure as well as supporting analytical tools and models. Hydrogen research will focus on improving natural gas steam methane reforming (SMR), blending hydrogen with natural gas, and leveraging existing transportation and storage infrastructure. The program will also develop analytical tools and models that are able to evaluate potential advanced technologies, technology performance metrics, technoeconomic and lifecycle analyses, and resource evaluations.

National Energy Technology Laboratory (NETL)

NETL Infrastructure. The FY 2022 Budget Request of $78 million supports the fixed costs of maintaining NETL's lab footprint in three geographic locations: Morgantown, WV; Pittsburgh, PA; and Albany, OR. These sites include approximately 240 acres of land, including 108 buildings with over 1,100,000 square feet of space. This level of funding includes $25 million for the design and construction of a DAC facility at an NETL campus. This DAC Center will be utilized to

lead agency-wide RDD&D projects to advance the development and commercialization of technologies to remove carbon from the air on a significant scale.

NETL Research and Operations. The request of $83 million supports the salaries, benefits, travel, and other employee costs for the NETL staff of engineers and technical professionals who conduct project management for FECM RDD&D programs. This program also funds partnership, technology transfer, and other collaborative research activities and supports the variable operating costs of NETL's research sites.

NETL and HQ Program Direction and Special Recruitment Programs. The request of $67.5 million ($37.4 million for headquarters, $29.4 million for NETL, and $0.7 million for Special Recruitment) provides for the FECM RDD&D organization's federal workforce and contractor support in the Washington, D.C. area including salaries and benefits, support service contracts, travel, training, the working capital fund, and other employee costs. These staff are responsible for the oversight and administration of the FECM RDD&D Programs and natural gas regulatory activities. In addition, funding for NETL federal technical staff and contractor support that provide Acquisition, Finance and Legal functions is supported.

($K)

	FY 2020 Enacted[1,2]	FY 2021 Enacted[1,3]	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted	
				$	%
Nuclear Energy					
Integrated University Program	5,000	5,000	6,000	+1,000	+20%
STEP R&D	5,000	5,000	0	-5,000	-100%
Reactor Concepts RD&D	267,000	208,000	240,000	+32,000	+15%
Fuel Cycle Research and Development	305,100	309,300	368,500	+59,200	+19%
Nuclear Energy Enabling Technologies	113,450	122,869	124,000	+1,131	+1%
Advanced Reactor Demonstration Program	230,000	250,000	370,350	+120,350	+48%
Versatile Test Reactor Project	0	45,000	145,000	+100,000	+222%
Infrastructure	334,450	337,500	356,850	+19,350	+6%
Idaho Sitewide Safeguards and Security	153,408	149,800	149,800	0	0%
International Nuclear Energy Cooperation	0	0	5,000	+5,000	+100%
Program Direction	80,000	75,131	85,000	+9,869	+13%
Total, Nuclear Energy	**1,493,408**	**1,507,600**	**1,850,500**	**+342,900**	**+23%**

Appropriation Overview

Nuclear Energy (NE) is a key element of the Administration's plan to put the United States (U.S.) on a path to net-zero emissions by 2050. America's nuclear energy sector provides approximately 55 percent of the nation's annual clean electricity and generates about 20 percent of U.S. electricity from a fleet of 94 operating units in 28 states. America's nuclear energy sector also plays key national security and global strategic roles for the U.S. including nuclear nonproliferation.

The U.S. pioneered the development and peaceful use of nuclear power to produce around-the-clock, emission-free, baseload electricity generation as well as the development of the civilian nuclear fuel cycle. The Office of Nuclear Energy (NE) is now leading the effort to move new and innovative advanced reactors, small modular reactors, and microreactors from the conceptual and development stages into the commercial energy sector. NE executes its mission through investments in research and development efforts with the national laboratories, U.S. universities, and industry technical organizations, as well as through partnerships with the U.S. industry and commercial stakeholders to develop and demonstrate advanced reactor technologies and designs.

Program Highlights

- **Reactor Concepts Research, Development and Demonstration**
  Activities will include cost-shared research under Advanced Small Modular Reactor Research and Development (R&D); support Light Water Reactor Sustainability through cost-shared efforts to extend the life and improve the economic competitiveness of the existing commercial nuclear reactor fleet through research in the areas of materials aging and degradation, safety margin characterization, safety technologies, and instrumentation and controls; and research into other Advanced Reactor Technologies for the production of electricity and high temperature process heat to improve the economic competitiveness and safety of nuclear energy as a resource capable of meeting the Nation's energy, environmental and climate goals.

[1] Funding does not reflect the transfer of SBIR/STTR to the Office of Science.

[2] Funding does not reflect the mandatory transfer of $85.5M from Naval Reactors for operation of the Advanced Test Reactor.

[3] Funding does not reflect the mandatory transfer of $91.0M from Naval Reactors for operation of the Advanced Test Reactor.

- **Fuel Cycle Research and Development**
  The Fuel Cycle Research and Development program conducts research and development (R&D) on advanced fuel cycle technologies that have the potential to accelerate progress on managing and disposing of the nation's spent fuel and high-level waste including efforts to establish an interim storage option for commercial spent fuel, improve resource utilization and emission-free energy generation, reduce waste, and limit proliferation risk. In FY22 the program will also begin an effort to support the availability of high-assay low-enriched uranium for civilian domestic use. Advancements in fuel cycle technologies support the enhanced availability, economics, sustainability, and security of nuclear-generated electricity in the United States (U.S.), further enhancing economic competitiveness while creating clean energy, union jobs in advanced manufacturing and science and technology (S&T). Also included in this program is funding for critical, foundational planning and development actions required to lay the groundwork for effective, environmentally-just implementation of consent-based siting for interim storage of the nation's used nuclear fuel.

- **Nuclear Energy Enabling Technologies**
  The Nuclear Energy Enabling Technologies (NEET) program conducts research and development (R&D) and makes strategic investments in research capabilities to develop innovative and crosscutting nuclear energy technologies to resolve nuclear technology development issues. The Crosscutting Technology Development (CTD) subprogram focuses on innovative research that directly supports the existing fleet of nuclear reactors and enables the development of advanced reactors and fuel cycle technologies, including topical areas such as advanced sensors and instrumentation; nuclear cybersecurity; innovative materials and manufacturing technologies; and integrated energy systems. Also, NEET invests in modeling and simulation tools for existing and advanced reactors and fuel system technologies. The program also provides industry, universities, and national laboratories with access to unique nuclear energy research capabilities through the Nuclear Science User Facilities (NSUF) subprogram. Collectively, NEET-sponsored activities support the Department's priorities to combat the climate crisis, create good paying jobs and provide the free and fair choice to join a union, drive advanced manufacturing, and promote equity and environmental justice by delivering innovative technology.

- **Advanced Reactor Demonstration Program**
  The Advanced Reactor Demonstration Program (ARDP) focuses Departmental and non-federal resources on the construction of demonstration reactors in the near- and mid-term that are safe and affordable to build and operate. The emphasis of the program is centered on two cost-shared (up to 50% government, not less than 50% industry) awards advanced demonstration reactors with significant improvements compared to the current generation of operational reactors. Additional longer-term efforts to partners with United States (U.S.)-based teams to address technical, operational, and regulatory challenges to enable development of a diverse set of advanced nuclear reactor designs for future demonstration. The program also supports R&D addressing safeguards and regulatory issues associated with advanced reactors and the programmatic infrastructure requirements to support the demonstration efforts.

- **Versatile Test Reactor Project**
  The Versatile Test Reactor (VTR) Project will provide the U.S. with a fast neutron testing capability to tackle the climate crisis, jumpstart clean energy manufacturing, and reestablish the U.S. as a global leader nuclear science and innovation. The VTR project will provide a leading-edge capability for accelerated testing of advanced nuclear fuels, materials, instrumentation, and sensors. Critical Decision (CD)-0, *Approve Mission Need*, was granted on February 22, 2019. Near-term VTR activities will focus on preliminary design and safety basis development, fuel design and production capabilities, and project risk reduction .

- **Infrastructure and Idaho National Laboratory Sitewide Safeguards and Security**
  The Idaho Sitewide Safeguards and Security Request supports the secure and effective availability of the Idaho National Laboratory to support nuclear energy, other DOE and US government research requirements. The Idaho National Laboratory Facilities Operations and Management subprogram continues investments at the Advanced Test Reactor (ATR) and Advanced Test Reactor Critical Facility (ATRC) to improve reliability and availability of the ATR, and continue operations at the Transient Reactor Test Facility (TREAT). The Idaho Sitewide Safeguards and Security program will increase the workforce and focus on continued implementation of infrastructure investments, capital improvements, emerging technology investments, and enhanced cybersecurity program capabilities to adequately secure site assets. The Infrastructure program also supports the provision of fresh reactor fuel to, and removal of used fuel from, 25 operating university research reactors to support their continued operation.

($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted	
				$	%
Indian Energy Policy and Programs					
Indian Energy Policy and Programs	17,000	17,000	116,477	+99,477	+585.2%
Program Direction	5,000	5,000	5,523	+523	+10.5%
Total, Indian Energy Policy and Programs	**22,000**	**22,000**	**122,000**	**+100,000**	**+454.5%**

Appropriation Overview

The Office of Indian Energy Policy and Program's (IE) financial and technical assistance are offered to Indian tribes, including Native Alaska villages, and eligible tribal entities for advancing electrification and clean energy development and deployment on Indian lands, reducing energy costs, and assisting economic development in tribal communities where unemployment and poverty rates far exceed national averages. This assistance is intended to overcome barriers to deploying energy generation (used for heat and electric power) and energy efficiency projects to reduced or stabilize energy costs and address energy poverty, as well as to provide power to unelectrified homes.

The Financial Assistance program will support funding opportunities toward energy development and electrification in Indian Country and Technical Assistance program to assist in overcoming barriers to project development and assist American Indians and Alaska Natives in planning to transition to clean energy and seven-generation planning. The FY 2022 Budget provides a major increase in funding for IE to fund the first year of two new multi-year initiatives: 1) transition all of the nation's tribal colleges and universities to renewable energy; and 2) electrify the roughly 30,000 tribal homes that currently lack electricity. Both efforts will include a substantial tribal job training component. DOE will work together with USDA and DOI to ensure that incentives are properly aligned, the right mix of loans, grants, and technical assistance is deployed, and the objectives are achieved as cost-effectively as possible, while fully respecting tribal sovereignty and self-determination. In addition to the two new initiatives, IE will expand the current program to assist Native community's transition to clean energy.

Program Highlights

The Office of Indian Energy Policy and Program's financial and technical assistance are beneficial to promoting energy development, efficiency, and use, reducing or stabilize energy costs, strengthening energy and economic infrastructure, and bringing electrical power and service to Indian land and homes, with the ancillary benefit of providing employment on Tribal Lands and in Native Alaskan communities. This assistance is intended to overcome barriers to energy development, increase energy reliability and resiliency, and electrify lands and homes.

Technical assistance facilitates expeditious energy deployment. By building internal technical capability and utilizing the DOE laboratories and partner organizations, local support is being provided. Specifically, increased on-site staff and local partner organizations, the Office of Indian Energy can deliver Alaskan solutions to Alaska Native communities with Alaskans familiar with the nuances and challenges of the state.

The Financial Assistance program provides support funding opportunities for energy infrastructure deployment in Indian Country and Alaska Native villages in the form of competitive grant awards. From 2010-2019, DOE's Office of Indian Energy has invested nearly $85 million in more than 180 tribal energy projects implemented across the contiguous 48 states and in Alaska. These projects, valued at over $180 million, are leveraged by $100 million in recipient cost share.

In FY 2020, the Office of Indian Energy selected nine tribal energy infrastructure projects for more than $5 million in funding. Combined, these projects add up to over 3.7 megawatts of installed generation that will power over 180 tribal buildings, with combined lifetime savings of over $24 million—significant investments that will yield tangible results to improve the quality of life for these communities.

In FY 2020, the Office of Indian Energy also offered the opportunity for eligible Indian tribes, including Alaska Native villages, and tribal entities to request a cost share reduction for both existing grants, as well as for projects to be proposed under the recent funding opportunity announcement. This flexibility resulted in an additional $17.75 million to thirty-one Tribes and tribal entities to help ease the financial hardships resulting from the COVID-19 pandemic.

($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2021 Request vs FY 2020 Enacted	
				$	%
Office of Technology Transitions					
Departmental Administration					
Office of Technology Transitions	0	17,639	0	-17,639	N/A
Other Departmental Administration					
Office of Technology Transitions	14,080	0	0	0	N/A
Office of Technology Transitions					
Program Direction	0	0	11,095	+11,095	N/A
Programs	0	0	8,375	+8,375	N/A
Total, Office of Technology Transitions	**14,080**	**17,639**	**19,470**	**+1,831**	**+10%**

Appropriation Overview

The mission of the Office of Technology Transitions (OTT) is to expand the commercial and public impact of the research investments of the DOE. OTT enhances the public return on investment in DOE's technology portfolio, including the National Laboratories, through a suite of outcome-oriented activities that will enable climate change mitigation, job creation, and commercialization of DOE technology. Internally, OTT works to fill gaps in the research, development, demonstration and deployment (RDD&D) continuum, providing specialized tools, training, analysis, and programs to improve the successful transition of technology from proof of concept to prototype to demonstration. OTT also supports enabling policies for, tracks the impact of, and shares success stories from the Department's commercialization and partnering activities. Externally, OTT supports development of a robust ecosystem for energy entrepreneurs and technology start-ups and seeds public-private partnerships with a diverse set of actors, including state, local and tribal entities; industry, financial, and other market players; as well as academia, non-profits, and philanthropic entities. Fundamentally, OTT leverages authorities under the Energy Act 2020 and supports innovative mechanisms to make the Department's RD&D more deployment-ready.

Program Highlights

In FY 2022, OTT is funded under a new, separate appropriation to increase transparency and reflect the need for multi-year funding for programmatic activities.

OTT's key activities in FY 2022 include:

- Technology Commercialization Fund – focuses on commercializing promising DOE technologies, especially those from the National Laboratories in order to 1) increase the pipeline of DOE-funded technologies transitioned to commercial deployment; and to 2) enhance the outcomes of the Department's commercialization initiatives with a competitive and proactive approach to public-private partnerships.
- Energy I-Corps – an immersive commercialization training program pairing National Laboratory scientists and engineers with industry mentors with a goal to develop entrepreneurial skillsets and engage in entrepreneurial opportunities which centers on customer outreach and partnership with the private sector.
- Lab Partnering Service – provides investors and external stakeholders interested in advancing energy innovation the ability to connect with leading DOE National Laboratory expertise, technologies, and facilities through a searchable, online platform that serves as a front door to the National Laboratory enterprise.
- Market Analysis – fills gaps in the Department's varied analytical efforts to maximize the impact of DOE engagement and collaboration with numerous partners including the industry, the financial community, interagency partners, and state and local policymakers.
- Energy Program for Innovation Clusters (EPIC)– a competitive funding program for incubators and accelerators supporting energy innovation clusters.

($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted	
				$	%
Administrative Expenses	32,000	32,000	32,000	-	0.0%
Title XVII Credit Subsidy	-	-	150,000	+ 150,000	N/A
Offsetting Collections	-3,000	-3,000	-3,000	-	0
Total, Title 17 Innovative Technology Loan Guarantee Program	**29,000**	**29,000**	**179,000**	**+150,000**	**517.2%**

Appropriation Overview

The Title 17 - Innovative Technology (Title 17) Loan Guarantee Program, as authorized under Title XVII of the Energy Policy Act of 2005 (EPAct of 2005), as amended, allows the Department of Energy (DOE) to provide loan guarantees for innovative energy projects in categories that include advanced nuclear facilities, coal gasification, carbon sequestration, energy efficiency, renewable energy systems, and various other types of projects. Through the Title 17 loan guarantee program, the Loan Programs Office (LPO) provides access to debt capital for large-scale infrastructure projects in the United States. These projects must avoid, reduce, or sequester air pollutants or anthropogenic emissions of greenhouse gases; employ new or significantly improved technologies compared to commercial technologies in service in the United States at the time the guarantee is issued; and offer a reasonable prospect of repayment of the principal and interest on the guaranteed obligation.

The Budget request continues the Title 17 Loan Guarantee Program because the program is ideally positioned to tackle the climate crisis and achieve a net-zero carbon emission economy by no later than 2050 by accelerating the deployment of innovative projects to help launch new clean energy markets, reduce greenhouse gas emissions, and drive American economic growth by providing flexible, custom financing and access to debt capital that helps to meet the specific needs of individual borrowers. This budget will allow LPO to continue actively monitoring its Title 17 Loan Guarantee Program portfolio and engaging resources to help support the achievement of project milestones, overcome issues that may arise, and provide guidance and risk mitigation for the long-term success of projects. Furthermore, LPO will continue originating loans for the Title 17 Innovative Technology Loan Guarantee Program.

The FY 2022 Budget begins the process of ensuring that Federal funding no longer directly subsidizes fossil fuels, as required in Section 209 of Executive Order 14008, Tackling the Climate Crisis at Home and Abroad. The Loan Program Office will ensure that the Title 17 program is only encouraging projects that help achieve a carbon-pollution free electric sector by 2035 and net-zero emissions, economy-wide, by 2050. The program will avoid directly subsidizing fossil fuels by excluding traditional fossil projects from consideration for a loan guarantee

Program Highlights

In FY 2022, LPO requests $32 million, offset by an estimated $3 million in collected fees, for administrative expenses to continue originating loans for the Title 17 Loan Guarantee Program, as well as to effectively monitor the existing portfolio. This funding level allows LPO to help achieve the Administration's climate and clean energy goals in FY 2022. This includes providing access to capital for domestic manufacturers revitalizing the U.S. manufacturing and supply chains, creating good-quality energy jobs, and investing in resilient clean energy infrastructure projects that deliver real results to the American people.

- The FY 2022 Budget requests $32 million, offset by an estimated $3 million in collected fees, for administrative expenses associated with carrying out the Title 17 Loan Guarantee Program.

- In addition to the requested amount, LPO will use approximately $23 million in available balances carried forward from prior-year appropriations to cover anticipated loan origination and loan portfolio monitoring activity.
- $150 million is requested for the credit subsidy costs, associated with an additional $1.5 billion of guaranteed loan authority, for innovative electric vehicle infrastructure, carbon management, and other clean energy projects that create good paying jobs with a free and fair choice to join a union.
- Title 17 available loan authority will increase by $1.5 billion from $22.4 billion to $23.9 billion.
- The request includes $16 million to cover costs for Third-Party Advisors as required by the Energy Act of 2020. These expenses will be recouped through fees assessed at financial closure of loan guarantees.

($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted	
				$	%
Administrative Expenses	5,000	5,000	5,000	-	0.0%
Total, Advanced Technology Vehicles Manufacturing Loan Program	**5,000**	**5,000**	**5,000**	**-**	**0.0%**

Appropriation Overview

Advanced Technology Vehicles Manufacturing (ATVM) Loan Program supports the manufacturing of advanced technology vehicles and associated components in the United States. ATVM provides loans to automobile and automobile part manufacturers for the cost of re-equipping, expanding, or establishing manufacturing facilities in the United States to produce advanced technology vehicles or qualified components and for associated engineering integration costs.

In FY 2022, LPO requests $5 million to originate ATVM direct loans and monitor the program's growing portfolio.

Program Highlights

The FY 2022 Budget requests $5 million for Administrative Expenses for the Advanced Technology Vehicles Manufacturing direct loan program. The program has been key in propelling the resurgence of the American auto manufacturing industry, and the budget requested will allow LPO to continue operating this crucial program. This funding level allows LPO to help achieve the Administration's climate and manufacturing objectives in FY 2022. This includes providing access to capital for domestic manufacturers revitalizing U.S. manufacturing, creating good-quality jobs electrifying vehicles, securing domestic supply chains from raw materials to parts, and retooling factories to compete globally.

Currently, the ATVM program is limited to support manufacturing of light-duty vehicles and components. The Administration believes the definition of advanced technology vehicles should be expanded to fully leverage the ATVM program to reduce transportation emissions and create good paying jobs that provide the free and fair choice to join a union.

The FY 2022 Budget begins the process of ensuring that Federal funding no longer directly subsidizes fossil fuels, as required in Section 209 of Executive Order 14008, Tackling the Climate Crisis at Home and Abroad. The Loan Program Office will ensure that ATVM is encouraging projects that support the transition to zero-emission vehicles and not directly subsidizing fossil fuels by excluding projects that manufacture gas-only light duty vehicles. Under an expanded definition of advanced technology vehicle, highly efficient fossil fueled medium- and heavy- duty vehicle manufacturing projects would be permitted to pursue a loan, though zero-emission vehicles would be encouraged.

- In FY 2022, the Budget requested will allow LPO to continue managing existing asset portfolio and originating activities on behalf of the ATVM direct loan program.
- Approximately $2 million in unobligated balances carried forward from prior-year appropriations will be utilized in addition to the requested $5 million to support increased loan origination, portfolio monitoring, and related administrative expenses.
- An increase of 6 Federal FTEs is requested for FY 2022.

($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted	
				$	%
Administrative Expenses	2,000	2,000	2,000	-	0.0%
Total	2,000	2,000	2,000	-	0.0%

Appropriation Overview

Tribal Energy Loan Guarantee Program (TELGP) Section 2602 of the Energy Policy Act of 1992, as amended by the Energy Policy Act of 2005, authorizes a loan guarantee program at the Department of Energy to support energy development by Indian tribes.

In FY 2022, the Loan Programs Office (LPO) requests $2 million to continue origination and monitoring related activities for TELGP to invigorate economic opportunities in tribal communities through the development of energy projects.

Program Highlights

The FY 2022 Budget allows the Tribal Energy Loan Guarantee Program to continue outreach and originating activities and to monitor its expected portfolio. This funding level allows LPO to help achieve the Administration's climate, clean energy, and Justice40 goals in FY 2022. Specifically, the Tribal Energy Loan Guarantee Program provides government support to encourage commercial lenders to provide debt capital to Tribal companies and organizations installing robust energy projects and creating jobs modernizing power generation in the nation's most vulnerable communities.

- In FY 2022, the Budget proposes $2 million to continue the Tribal Energy Loan Guarantee program.
- LPO will utilize approximately $.5 million in unobligated balances carried forward from prior year appropriations in addition to the requested $2 million to support increased loan origination and related administrative expenses.

($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted	
				$	%
National Nuclear Security Administration					
Federal Salaries and Expenses	434,699	443,200	464,000	+20,800	+4.7%
Weapons Activities	12,457,097	15,345,000	15,484,295	+139,295	+0.9%
Defense Nuclear Nonproliferation	2,164,400	2,260,000	2,264,000	+4,000	+0.2%
Naval Reactors[1]	1,648,396	1,684,000	1,866,705	+182,705	+10.8%
NNSA Cancellation of Prior Year Balances[2]	-	-	(336,000)	(336,000)	N/A
Total, National Nuclear Security Administration	**16,704,592**	**19,732,200**	**19,743,000**	**+10,800**	**+0.1%**

Appropriation Overview

The **National Nuclear Security Administration (NNSA)** FY 2022 Budget Request is $19,743,000,000 to fund NNSA's mission to support the security and safety of our nation. NNSA's FY 2022 Budget Request pursues five major national security endeavors:

- Maintain a safe, secure, and effective nuclear weapons stockpile;
- Reduce global nuclear threats and keep materials out of the hands of terrorists;
- Strengthen key science, technology and engineering capabilities in support of certification, assessment, and current and future life extension programs;
- Provide safe and effective integrated nuclear propulsion systems for the U.S. Navy; and,
- Modernize the Nuclear Security infrastructure. Key to all of these efforts is providing the necessary federal oversight for growing mission requirements.

Major Outyear Priorities and Assumptions

Consistent with the past two transition year budgets (FY 2018 and FY 2010), the FY 2022 President's Budget does not include program-based defense budget levels beyond the budget year. Instead, the defense estimates for FY 2023-2026 simply reflect inflated FY 2022 levels, not policy judgments. The Administration will include outyear defense program funding levels in the FY 2023 Budget, in accordance with strategy documents currently under development. The FY 2023 President's Budget will be accompanied by a Future Years Nuclear Security Program that reflects this Administration's policy judgments.

[1] Funding does not reflect the mandated transfer of $88.5 million in FY 2020 and $91.0 million in FY 2021 to the Office of Nuclear Energy for operation of the Advanced Test Reactor.
[2] Includes $330 million from project 99-D-143, Mixed Oxide Fuel Fabrication Facility, SRS, within Defense Nuclear Nonproliferation and $6 million from completed construction projects within Naval Reactors.

($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted	
				$	%
Federal Salaries and Expenses					
Federal Salaries and Expenses	434,699	443,200	464,000	+20,800	+4.7%
Total, Federal Salaries and Expenses	**434,699**	**443,200**	**464,000**	**+20,800**	**+4.7%**

Appropriation Overview

The **National Nuclear Security Administration (NNSA) Federal Salaries and Expense** (FSE) funds recruiting, training, and retention of federal staff who perform program and project management for approximately $17.7 billion in Weapons Activities (WA) and Defense Nuclear Nonproliferation (DNN). The modest growth in the FSE account will support 1,920 Federal Full-time Equivalents (FTEs) which is approximately 150 additional FTEs above the FY 2021 plan, and includes 1,898 who are paid from FSE and 22 who are paid through the Working Capital Fund. FSE also provides space and occupancy needs, travel costs, support service contractors, training, and other related expenses. Eighty-two percent of FY 2022 FSE funds are for federal salaries and benefits.

The NNSA workforce consists of a diverse team of scientists, engineers, project and program managers, foreign affairs specialists, and support staff that perform program and project management and appropriate oversight of the national security missions related to the WA and DNN accounts.

NNSA federal staff are located throughout the United States, reflecting NNSA's work with the nuclear security enterprise. NNSA's federal workforce is in Washington, DC; Germantown, Maryland; Albuquerque, New Mexico; and at seven federal field offices: Kansas City Field Office (Missouri); Lawrence Livermore Field Office (California); Los Alamos Field Office (New Mexico); Nevada Field Office (Nevada); NNSA Production Office (Texas and Tennessee); Sandia Field Office (New Mexico); and Savannah River Field Office (South Carolina).

NNSA also manages the Department of Energy's (DOE) Overseas Presence business line in the DOE Working Capital Fund (WCF), including 22 DOE/NNSA staff in 21 foreign countries. NNSA supervises both federal employees and locally employed staff overseas and reimburses the Department of State for International Cooperative Administrative Support Services (ICASS) and Capital Security Cost Sharing (CSCS) charges.

Program Highlights

The $464,000,000 request supports 1,920 FTEs and associated support expenses.

The NNSA workforce is critical to the success of the Nation's nuclear security enterprise. The right number of people, with the right skills, in the right positions is key to the growing mission including modernizing the nuclear deterrent, recapitalizing the aging infrastructure, and continuing to meet the requirements of nonproliferation and counterterrorism programs.

NNSA will use a variety of innovative methods to grow and shape the professional staff including recruitment events and expanded excepted service hiring authority. NNSA will continue to monitor the evolving need for federal oversight in support of the nuclear modernization missions and adjust future staffing plans accordingly. NNSA will also use partnerships with academic alliances to grow the workforce with early identification and recruitment of top science, technology, engineering, and math talent. NNSA's recruitment and hiring actions will continue to support the Administration goals of promoting racial and economic equity while promoting science and research and development.

	($K)				
	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted	
				$	%
Weapons Activities					
Stockpile Management	3,680,051	4,290,244	4,632,676	+342,432	+8.0%
Production Modernization	1,565,523	2,547,897	2,910,979	+363,082	+14.3%
Stockpile Research, Technology, and Engineering	2,553,119	2,813,689	2,690,631	-123,058	-4.4%
Infrastructure and Operations	3,199,544	4,087,507	3,586,436	-501,071	-12.3%
Secure Transportation Asset	292,660	348,684	330,764	-17,920	-5.1%
Defense Nuclear Security	775,000	789,078	847,623	+58,545	+7.4%
Information Technology and Cybersecurity	300,000	366,233	406,530	+40,297	+11.0%
Legacy Contractor Pensions and Settlement Payments	91,200	101,668	78,656	-23,012	-22.6%
Total, Weapons Activities	**12,457,097**	**15,345,000**	**15,484,295**	**+139.295**	**0.9%**

Appropriation Overview

Programs funded within the Weapons Activities appropriation support the Nation's nuclear stockpile and its attendant nationwide infrastructure of science, technology, engineering, and production capabilities. Weapons Activities provides for the maintenance and refurbishment of nuclear weapons to continue sustained confidence in their safety, reliability, and military effectiveness without resuming nuclear explosive testing; continued investment in scientific, engineering, and manufacturing capabilities to enable production and certification of the enduring nuclear weapons stockpile; and manufacture of nuclear weapon components. Weapons Activities also provides for continued maintenance and investment in the National Nuclear Security Administration (NNSA) nuclear complex to be more responsive and resilient.

NNSA's laboratories, plants, and sites employ approximately 50,000 people across the Enterprise, primarily at eight geographical sites, to execute these programs managed by a Federal workforce composed of civilian and military staff. Additional details about these programs will be included in the FY 2022 Stockpile Stewardship and Management Plan (SSMP).

The FY 2022 Request supports the current nuclear stockpile, warhead modernization programs to include life extension programs (LEP) and modifications, production facilities and capabilities modernization efforts, the scientific tools necessary to execute these efforts, and recapitalization of physical infrastructure and essential facilities to ensure the deterrent remains viable. The request preserves space for future policy decisions related to nuclear modernization and when combined with prior year balances, will enable NNSA to execute its current program while the Administration undertakes its formal review of efforts to modernize the nuclear weapons stockpile and infrastructure.

Program Highlights

- **Stockpile Management**
  Maintains a safe, secure, and militarily effective nuclear weapons stockpile. Activities include: sustaining the current active stockpile to include the Annual Assessment Process, surveillance, minor alterations and limited life component exchanges; extending the expected life of the stockpile weapons to include life extension programs, and major modifications and alterations; providing safe and secure dismantlement of nuclear weapons and components; and providing sustainment of needed manufacturing capabilities and capacities, including process improvements, quality assurance, and investments focused on increased efficiency of production operations. The FY 2022 Request includes increases for the W80-4 LEP and the W87-1 Modification Program to maintain first production unit schedules of FY 2025 and FY 2030, respectively and the W93 Program to include support for potential transition from Phase 1 (concepts study) to Phase 2 (review of these concepts into a specific set of design options to be down-selected to a final design). The Request also supports the start of a Design Definition and Cost Study for the W80-4 Alteration for the Navy's Sea-Launched Cruise Missile-Nuclear (SLCM-N).

- **Production Modernization**
  Focuses on the production capabilities for nuclear weapons components critical to weapon performance, including primaries, secondaries, radiation cases and non-nuclear components needed to sustain the nuclear stockpile near- to long-term. This includes the equipment, facilities, and personnel required to reestablish the Nation's capability to

produce 80 pits per year (ppy). FY 2022 funding will continue process development and qualification activities to continue advancing towards producing the first War Reserve (WR) pit during FY 2023 at Los Alamos National Laboratories and the Plutonium Modernization activities at the Savannah River Site. Production Modernization also supports qualification of explosive, pyrotechnic, and propellant materials for supplying the NNSA's nuclear security enterprise across five sites; implements the program necessary to produce tritium in support of the nuclear weapons stockpile and other national programs; funds modernization of uranium operations, delivery of canned subassemblies and components needed to maintain the stockpile, as well as support to the U.S. Nuclear Navy, and Nonproliferation programs; supports the restart and modernization of lapsed depleted uranium (DU) alloying and component manufacturing capabilities for meeting short- and long-term mission requirements; maintains production of the Nation's enriched lithium supply; and provides funding to modernize production of non-nuclear components required for both the active stockpile and warhead modernization programs.

- **Stockpile Research, Technology, and Engineering**
  Provides the scientific foundation for science-based stockpile decisions and actions, including the capabilities, tools, and components needed to enable assessment of the active stockpile and certification of warhead modernization programs without the need for underground nuclear testing. Funding requested for FY 2022 supports the continued implementation of the Enhanced Capabilities for Subcritical Experiments (ECSE) and various activities in preparation to accept and operate NNSA's first Exascale high performance computing system. Both of these capabilities are required to meet W80-4 LEP confirmation experiment and W87-1 Modification certification requirements. In addition to the procurement and implementation of NNSA's first Exascale machine, the funding supports the necessary development of the design, engineering, and adaptation of physics and engineering codes needed to support stockpile decisions to operate on this new platform. Funding in this area also supports the development of new materials, technologies, and processes to evolve our nuclear systems and production complex. This is accomplished through warhead component and production technology development and maturation needed for on-going, planned, and future warhead modernization programs. Funding in this area supports the Administration's Equity EO, Academic Alliances and existing partnerships with Minority Serving Institutions and the development of the next generation of diverse, highly trained technical workers able to support NNSA's core missions. Increase student engagement and internship opportunities and confirm the hiring of various minority students into the NSE that have matriculated through various STEM consortium pipelines. It also reinvigorates and develops the future generation of the highly-trained technical and specialized workforce by experimental and computational programs along with academic institutions.

- **Infrastructure and Operations (I&O)**
  I&O maintains, operates, and modernizes the NNSA infrastructure in a safe and secure manner to support program execution while seeking to maximize return on investment and reduce enterprise risk. The program also plans, prioritizes, and constructs state-of-the-art facilities, infrastructure, and scientific tools. The FY 2022 Request will support plutonium pit production, meet LEP schedules at KCNSC, and address infrastructure modernization. Furthermore, the funding will allow NNSA to execute Recapitalization projects to improve the condition and extend the design life of structures, capabilities, and systems to meet program demands; reduce future operating costs by replacing older facilities with new, efficient facilities; and reduce risk to safety, security, environment, and program.

- **Secure Transportation Asset (STA)**
  STA supports safe, secure transport of the Nation's nuclear weapons, weapon components, and special nuclear material throughout the nuclear security enterprise to meet nuclear security requirements. Program Direction resources in this account provides salaries and expenses for the secure transportation workforce, including Federal agents. The pillars of the STA security concept are specialized vehicles to include highly secure trailers, well trained agents, and robust communication systems. The Request supports modernizing STA transportation assets, including life extension of the Safeguards Transporter (until the Mobile Guardian Transporter becomes operational in FY 2025); vehicle sustainment; replacement armored tractors, escort and support vehicles; upgrades of the Tractor Control Unit to accommodate for communications and security; and continued development and testing of the Mobile Guardian Transporter. Funding also supports a commitment to a stable human resources strategy to maintain the staff of Federal Agents.

- **Defense Nuclear Security (DNS)**
  DNS provides protection for NNSA personnel, facilities, nuclear weapons, and materials from a full spectrum of threats ranging from minor security incidents to acts of terrorism at our national laboratories, production plants, processing facilities, and the Nevada National Security Site. Employing more than 1,800 Protective Force officers, DNS secures more than 4,400 buildings and protects more than 62,000 personnel. The FY 2022 Request includes funding to fill positions in key security program areas required to implement a risk-based, layered protection strategy at the sites. The

Request also supports increased security needs associated with known mission growth in Weapons Programs across the NSE, including Pit Production at Los Alamos National Laboratory (LANL) and Kansas City expansion efforts; begins efforts to replace the aging Argus system with a modern security system, Caerus; and begins efforts to implement additional security requirements resulting from completed DBT analysis. It also includes funding for continued efforts to recapitalize security infrastructure through SIRP projects, which a focus on the highest-priority security systems and related security infrastructure and equipment refresh needs, as well as funding for the WEPAR project, which will install a new Perimeter Intrusion Detection and Assessment System (PIDAS) section, reducing the Y-12 National Security Complex (Y-12) Protected Area by approximately 50%.

- **Information Technology (IT) and Cybersecurity**
  The NNSA Office of the Associate Administrator for Information Management and Chief Information Officer (OCIO) is responsible for information sharing and information safeguarding that support the execution of NNSA mission activities and implementation of the President's Executive Order on Improving the Nation's Cybersecurity. The OCIO supports Information Technology (IT) and Cybersecurity services and solutions, which include continuous monitoring, cloud-based technologies, and enterprise security technologies (i.e., identity, credential, and access management) to meet security challenges. The IT and Cybersecurity Program is based on practical principles that provide superior information management support to current operations while implementing unclassified and classified cloud-based technologies and infrastructure to support the Nuclear Security Enterprise (NSE). The program collaborates and coordinates with the DOE Office of the Chief Information Officer (DOE OCIO) on the development and deployment of IT and Cybersecurity solutions protecting DOE information and information assets. The FY 2022 Request enables the development and execution of integrated IT initiatives that provide an effective and secure technology infrastructure across the enterprise. These initiatives will fundamentally redesign the NNSA IT environments to provide a more modern and secure set of capabilities including unified communication, agile cloud infrastructure, and next-generation collaboration services. Additionally, the NNSA IT and Cybersecurity Program will deploy emerging technology, leading-edge operational technology, and artificial intelligence/machine learning to provide tools and capabilities to the NNSA workforce and that secure NNSA operations. The Request also includes funding for the operation and modernization of the Emergency Communications Network previously funded under the Emergency Operations Program within the Defense Nuclear Nonproliferation Account.

($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted	
				$	%
Defense Nuclear Nonproliferation Programs					
Material Management and Minimization	363,533	400,711	342,946	-57,765	-14.4%
Global Material Security	442,909	528,939	497,941	-30,998	-5.9%
Nonproliferation and Arms Control	140,000	148,000	184,795	+36,795	+24.9%
National Technical Nuclear Forensics R&D[1]	-	40,000	-	-40,000	N/A
Defense Nuclear Nonproliferation R&D[1]	533,163	601,900	672,736	+70,836	+11.8%
Nonproliferation Construction	299,000	148,589	156,000	+7,411	+5.0%
Total, Defense Nuclear Nonproliferation Programs	**1,778,605**	**1,868,139**	**1,854,418**	**-13,721**	**-0.7%**
Nuclear Counterterrorism and Incident Response	372,095	377,513	370,782	-6,731	-1.8%
Legacy Contractor Pensions and Settlement Payments	13,700	14,348	38,800	+24,452	+170.4%
Total, Defense Nuclear Nonproliferation[2]	**2,164,000**	**2,260,000**	**2,264,000**	**+4,000**	**+0.2%**

Appropriation Overview

The National Nuclear Security Administration's (NNSA) nonproliferation, counterproliferation, and counterterrorism activities are critical to implementing the President's Interim National Security Strategic Guidance and demonstrating "renewed American nonproliferation leadership." NNSA's programs help reduce the dangers posed by nuclear weapons by extending the United States' defenses against nuclear threats far beyond its borders. These programs help prevent adversaries from acquiring nuclear weapons or weapons-usable materials, technology, and expertise; countering efforts to acquire such weapons or materials; and responding to nuclear or radiological incidents and accidents domestically and abroad. NNSA shares knowledge, accrued through the United States' long experience in managing special nuclear materials, with partners around the world to achieve international nonproliferation and nuclear security goals. NNSA uses the unique technical and scientific knowledge that underpins the Stockpile Stewardship Program for a range of nonproliferation missions, from assessing foreign weapons programs and potential terrorist devices to managing the proliferation risks posed by civil nuclear applications. By limiting the number of nuclear-capable states and preventing terrorist access to materials and technology that can threaten the United States and allies, NNSA plays a critical role in enhancing global stability and constrains the range of potential threats facing the nation, our allies, and partners.

This appropriation funds five programs that, as part of a whole-of-government approach, provide policy and technical leadership to prevent or limit the spread of weapons of mass destruction (WMD)-related materials, technology, and expertise; develop technologies to detect nuclear proliferation and steward foundational nonproliferation competencies; secure or eliminate inventories of nuclear weapons-related materials and infrastructure; and ensure that technically trained emergency management personnel are available to respond to nuclear and radiological incidents and accidents domestically and abroad.

DNN's mission is complementary to Defense Programs' Stockpile Stewardship Program at NNSA. Together, the programs form the basis of providing a strong nuclear defense. DNN's activities are carried out within a dynamic global security environment, as described in NNSA's annual report *Prevent, Counter, and Respond–A Strategic Plan to Reduce Global Nuclear Threats*[3] and in the Office of Defense Nuclear Nonproliferation's Strategic Vision for FY 2020 – FY 2024.

This environment is characterized by the persistent threat of state and non-state actors seeking to obtain nuclear and radioactive materials; state actors potentially undermining arms control agreements to which the United States is adherent; and nonproliferation regimes. There is also an increased risk of the availability of nuclear and radioactive materials as a result of the global expansion of commercial nuclear power and possible spread of fuel cycle technology, increased opportunities for illicit nuclear material trafficking and sophisticated procurement networks, and technology advances

[1] In FY 2022, National Technical Nuclear Forensics R&D is moved to a new subprogram in Defense Nuclear Nonproliferation Research and Development.

[2] Throughout this document, funding does not reflect the proposed cancellation of $330 million in unobligated balances remaining from project 99-D-143 Mixed Oxide (MOX) Fuel Fabrication Facility, SRS.

[3] https://www.energy.gov/nnsa/downloads/prevent-counter-and-respond-strategic-plan-reduce-global-nuclear-threats-npcr

(including cyber-related tools) that may shorten nuclear weapon development timelines and complicate nuclear safeguards and security missions.

Program Highlights

- **Material Management and Minimization (M3)**

  M3 programs minimize and, when possible, eliminate weapons-usable nuclear material around the world to achieve permanent threat reduction. The Request supports the conversion or shutdown of research reactors and isotope production facilities that use highly enriched uranium (HEU), the continued support of non-HEU-based Molybdenum-99 (Mo-99) production facilities in the United States, the removal and disposal of weapons-usable nuclear material, the continuation of activities to expedite the removal of plutonium from the State of South Carolina and implement the dilute and dispose strategy for plutonium disposition, and costs to downblend HEU.

- **Global Material Security (GMS)**

  GMS directly contributes to national security efforts to reduce global nuclear security threats. The FY 2022 Budget Request supports program efforts to prevent terrorists and other actors from obtaining nuclear and radioactive material to use in an improvised nuclear device (IND) or a radiological dispersal device (RDD) by working domestically and with partner countries to improve the security of vulnerable materials and facilities, and to build partners' sustainable capacity to detect, disrupt, and investigate illicit trafficking of these materials through critical pathways. GMS works with countries in bilateral partnerships and with multilateral partners such as the International Atomic Energy Agency (IAEA) and International Criminal Police Organization (INTERPOL). As part of an ongoing strategic analysis process, GMS is also exploring innovative approaches, technologies, and tools to adapt to emerging threats. GMS supports national security priorities to reduce global nuclear security threats, and is a key component of NNSA's integrated nonproliferation, counterterrorism, and emergency response strategies.

- **Nonproliferation and Arms Control (NPAC)**

  NPAC programs strengthen the nonproliferation and arms control regimes through innovative policy development and implementation to prevent proliferation, ensure peaceful nuclear uses, and enable verifiable nuclear reductions. To advance this mission, NPAC builds the capacity of the IAEA and partner countries to implement international safeguards obligations, builds domestic and international capacity to implement export control obligations, supports the negotiation and implement of agreements and associated monitoring regimes to verifiably reduce nuclear weapons and nuclear programs, and develops approaches and strategies to address emerging nonproliferation and arms control challenges and opportunities.

- **Defense Nuclear Nonproliferation Research and Development (DNN R&D)**

  DNN R&D is the key component for the innovation of United States' technical capabilities to detect nuclear detonations; foreign nuclear weapons programs' activities; and the presence, movement, or diversion of special nuclear materials. The program also sustains and develops foundational nonproliferation technical competencies that ensure the technical agility needed to support a broad spectrum of U.S. nonproliferation missions and anticipate threats. DNN R&D uses the unique facilities and scientific skills of DOE, academia, and industry to perform research, conduct technology demonstrations, develop prototypes, and produce and deliver sensors for integration into operational systems. The Request supports planned activities for early detection of proliferation-related R&D and continued production of nuclear detonation detection satellite payloads. The Request also supports continued efforts to sustain and develop foundational nonproliferation technical competencies by providing targeted, long-term support for enabling infrastructure, science and technology, and an expert workforce. The request realigns the FY 2021 National Technical Nuclear Forensics R&D program to a new subprogram within DNN R&D, to continue developing and maintaining advanced technical nuclear forensics analysis capabilities at the National Laboratories that can support time-critical decisions in the event of a nuclear or radiological incident and assist in determining the origin of interdicted materials or nuclear devices.

- **Nonproliferation Construction (supports Material Management and Minimization)**

  Nonproliferation Construction consolidates construction costs for DNN projects. The Request supports the implementation of the dilute and dispose strategy, with the continuation of design for the Surplus Plutonium Disposition (SPD) project, as well continuation of early site preparations and long lead procurements. The SPD project will add additional glovebox capacity at the Savannah River Site to accelerate plutonium dilution and aid in the removal of plutonium from the state of South Carolina. With use of available prior year balances, physical termination activities for the Mixed Oxide Fuel Fabrication Facility (MOX) project will be completed in FY 2021 and closeout activities will be completed in FY 2022.

- **Nuclear Counterterrorism and Incident Response Program (NCTIR)**
  The NCTIR program sustains the United States' nuclear counterterrorism and counterproliferation activities as well as operational nuclear incident and accident response capabilities, while supporting DOE's all-hazards emergency management system. The Counterterrorism and Counterproliferation (CTCP) subprogram provides the nation's technical capability to understand and defeat nuclear devices, including improved nuclear devices and lost or stolen foreign nuclear weapons. This knowledge in turn informs U.S. Government policies, regulations, agencies, and key Department of Defense mission partners on terrorist and proliferant state nuclear threats and related contingency planning. In support of this mission, the FY 2022 Request for NCTIR supports programs to strategically manage and deploy the DOE/NNSA Nuclear Emergency Support Team (NEST), comprised of expert scientific teams and equipment to provide a technically trained, rapid response to nuclear or radiological incidents and accidents worldwide, a nuclear forensics capability to support material and attack attribution, and to educate international partners to respond effectively to nuclear or radiological incidents in their countries. CTCP also integrates DOE/NNSA policy, planning, and operations on counterproliferation priorities, supporting urgent needs and proactively pursuing opportunities to prevent nuclear threats and develop technologies to apply to the counterproliferation mission.

  Additionally, NCTIR operates the DOE/NNSA's Emergency Operations (EO) subprogram. The (EO) subprogram provides both the structure and processes to ensure a comprehensive and integrated approach to emergency management, improving readiness and effectiveness of the DOE Emergency Management System on a programmatic and performance level, while promoting unity of effort and a culture of continuous improvement to safeguard the health and safety of workers and the public, protect the environment, and enhance the resilience of the Department and the Nation. In addition, the FY 2022 NCTIR EO request supports Continuity of Operations, Continuity of Government, and Enduring Constitutional Government programs to advance the National Continuity Policy and ensure the continued performance and delivery of essential services under any circumstances. The request also provides for 24/7/365 Consolidated Emergency Operations Center support to the DOE/NNSA Emergency Management Enterprise and Departmental Senior Leadership.

($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted	
				$	%
Naval Reactors					
Naval Reactors Operations and Infrastructure	553,591	530,600	594,017	+63,417	12.0%
Naval Reactors Development	516,205	568,000	640,684	+72,684	12.8%
S8G Prototype Refueling	170,000	135,000	126,000	-9,000	-6.7%
Columbia-Class Reactor Systems Development	75,500	64,700	55,000	-9,700	-15.0%
Program Direction	50,500	51,700	55,579	+3,879	7.5%
Construction	282,600	334,000	395,425	+61,425	18.4%
Subtotal, Naval Reactors[1]	**1,648,396**	**1,684,000**	**1,866,705**	**+182,705**	**10.8%**

Appropriation Overview

The Naval Reactors (NR) appropriation includes funding for U.S. Navy nuclear propulsion work, beginning with reactor plant technology development and design, continuing through reactor plant operation and maintenance, and ending with final disposition of naval spent nuclear fuel.

Program Highlights

Funding for the program supports continued safe and reliable operation of the Navy's nuclear-powered fleet (70 submarines, 11 aircraft carriers, and 5 research, development, and training platforms)[2]. The Program's development work consists of refining and improving existing technology to ensure that the U.S. Navy's nuclear propulsion plants are increasingly efficient and effective and will be capable of meeting future threats to national security.

In addition to supporting the existing nuclear fleet, NR has three major DOE initiatives—the *Columbia*-Class Reactor System Development, the Land-based S8G Prototype Refueling Overhaul, and the Spent Fuel Handling Recapitalization Project.

NR supports national security with the continued development of the reactor plant system for the *Columbia*-Class submarine and stewardship of naval nuclear infrastructure. Ensuring the continuity of a sea-based strategic deterrent, the President's FY 2022 Budget provides for the research, design, and development of the reactor plant system for the *Columbia*-Class submarine, to include the development of a life-of-ship reactor core. The budget further provides funding for the refueling and overhaul of the Land-based S8G Prototype reactor, a critical research and development asset for the long-term. The Spent Fuel Handling Recapitalization Project will also support the capability to refuel and defuel aircraft carriers and submarines, which is critical to maintaining the nuclear fleet's operational availability for national security missions.

- **Naval Reactors Operations and Infrastructure**

  The FY 2022 Request supports facility and systems maintenance and regulatory requirements across the Program's four DOE sites, environmental remediation, and necessary minor construction projects to recapitalize deteriorating infrastructure and equipment.

- **Naval Reactors Development**
  The FY 2022 Request supports the unique technologies used in naval reactors that are crucial to delivering superior navy fleet operations and dominance in the maritime domain.

[1] Funding does not reflect the mandated transfer of $88.5 million in FY 2020 and $91.0 million in FY 2021 to the Office of Nuclear Energy for operation of the Advanced Test Reactor.
[2] Major combatants, in this instance, include aircraft carriers, submarines, and surface combatants based on the "Active in Commission" column from the Naval Vessel Register.

- **S8G Prototype Refueling**
  The funding decrease reflects the project's revised funding profile and supports refueling overhaul execution and completion in early FY 2023.

- ***Columbia*-Class Reactor Systems Development**
  The decrease from FY 2021 is consistent with the planned project profile and supports FY 2022 production, analysis, and testing execution.

- **Construction**
  The increase from FY 2021 includes additional resources required for the Spent Fuel Handling Recapitalization Project, in addition to funding two new start major construction projects.

- **Program Direction**
  The FY 2022 Request includes increases necessary to progress staffing plans to meet authorized FTE levels, and places NR in a position to execute its mission and provide federal oversight of the program's DOE laboratories.

($K)

Environmental Management by Site	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs. FY 2021 Enacted	
				$	%
Carlsbad/Waste Isolation Pilot Plant (WIPP)	403,599	420,066	437,230	+17,164	+4.1%
Idaho National Laboratory	446,300	444,500	380,583	-63,917	-14.4%
Oak Ridge	682,348	644,344	561,244	-83,100	-12.9%
Paducah	314,339	315,885	275,303	-40,582	-12.8%
Portsmouth	493,427	508,864	546,636	+37,772	+7.4%
Richland	1,001,301	1,024,900	1,026,297	+1,397	+0.1%
River Protection	1,616,000	1,645,000	1,540,642	-104,358	-6.3%
Savannah River	1,629,924	1,702,870	1,746,219	+43,249	+2.5%
Lawrence Berkeley National Laboratory	31,000	30,100	0	-30,100	-100.0%
Lawrence Livermore National Laboratory	66,727	36,764	36,806	+42	+0.1%
Los Alamos National Laboratory	220,000	226,000	333,500	+107,500	+47.6%
Nevada	66,727	60,737	60,737	0	0.0%
Sandia National Laboratories	2,652	4,860	4,576	-284	-5.8%
Separation Process Research Unit (SPRU)	15,300	15,000	15,000	0	0.0%
West Valley Demonstration Project	79,611	92,411	92,418	+7	+0.01%
Energy Technology Engineering Center	18,200	12,000	21,340	+9,340	+77.8%
Moab	45,000	47,833	85,000	+37,167	+77.7%
Other Sites	14,987	14,987	15,984	+997	+6.7%
Headquarters Operations	12,979	12,979	62,979	+50,000	+385.2%
Technology Development	25,000	30,000	25,000	-5,000	-16.7%
Uranium/Thorium Reimbursement Program	5,250	5,000	33,500	+28,500	+570.0%
Program Direction	281,119	289,000	293,106	+4,106	+1.4%
Management and Storage of Elemental Mercury	1,200	2,100	2,100	0	0.0%
Mercury Storage Receipts	0	3,000	0	-3,000	-100%
UED&D Fund Deposit	0	0	415,670	+415,670	+100%
Subtotal, Environmental Management by Site Adjustments	**7,467,000**	**7,589,200**	**8,011,870**	**+422,670**	**+5.6%**
Mercury Storage Receipts	0	**-3,000**	0	3,000	+100%
Use of Prior Year Balance (15-D-401 Containerized Sludge Removal)	-11,800	0	**0**	0	0.0%
UED&D Fund Offset	0	0	**-415,670**	-415,670	-100%
Total, Environmental Management by Site	**7,455,200**	**7,586,200**	**7,596,200**	**+10,000**	**+0.13%**

Appropriation Overview

The **Office of Environmental Management (EM)** supports the Department of Energy (DOE) to meet the challenges of the nation's Manhattan Project and Cold War legacy responsibilities. EM was established in 1989 and is responsible for the cleanup of millions of gallons of liquid radioactive waste, thousands of tons of spent (used) nuclear fuel and nuclear materials, disposition of large volumes of transuranic and mixed/low- level waste, huge quantities of contaminated soil and water, and deactivation and decommissioning of thousands of excess facilities. It involves some of the most dangerous materials known to mankind. To date, EM has completed cleanup activities at 92 sites in 30 states and in the Commonwealth of Puerto Rico. EM is currently responsible for cleaning up the remaining 15 sites in 11 states.

The record nominal request for the EM program advances the Administration's whole-of-government effort to tackle climate change, address inequities and an historic movement for justice, and support economic revitalization with jobs that provide a choice to join a union. As the EM program cleans up the legacy from six decades of nuclear weapons development and production and Government-sponsored nuclear energy research, it will transition to the zero-emissions operations to the extent feasible at the Waste Isolation Pilot Plant; support environmental justice at Los Alamos National Lab and other sites; invest in Historically Black Colleges and Universities and other Minority Serving Institutions; expand engagement with Tribal Nations; and sustain union jobs in energy communities like the Portsmouth site.

Program Highlights

- **Savannah River**

  At the Savannah River Site, the FY 2022 request supports the Liquid Waste Program, to achieve additional risk reduction by stabilization and immobilization of high activity radionuclides through vitrification into canisters at the Defense Waste Processing Facility and disposition of decontaminated salt solution in Saltstone Disposal Units. The mission of the Saltstone Disposal Units #8 and #9 project is to construct two cylindrical reinforced concrete tanks designed to contain approximately 30,000,000 gallons of Saltstone grout each, which is the waste from the disposition of the decontaminated salt solution resulting from salt waste processing. The mission of the Saltstone Disposal Units 10-12 project is to construct three cylindrical reinforced concrete tanks designed to contain approximately 30,000,000 gallons of Saltstone grout each. The Salt Waste Processing Facility will operate at a rate of 6 million gallons per year, marking 2022 as the first year of bringing the whole liquid waste system into operations, making it capable of processing the bulk of the waste stored in the tank farms in approximately a decade.

  The FY 2022 request also supports continued risk reduction of the Nuclear Materials Program missions to store, stabilize, and disposition EM-owned nuclear materials and spent nuclear fuel, as well as, support the mission for maintaining the safe and environmental compliant state of excess nuclear processing facilities until their decommissioning. The Nuclear Materials Program missions at SRS includes operations of H-Canyon, L-Basin, K-Area Facilities, and the surveillance and maintenance of excess nuclear facilities in F-Area. In FY 2022, H-Canyon will continue processing spent nuclear fuel. The mission for the K-Area Facilities is to safely store surplus plutonium and to down blend the material into an acceptable waste form for disposition at the Waste Isolation Pilot Plant in Carlsbad, New Mexico. In FY2022, the K-Area Facilities will continue glovebox operations and increase down blending of plutonium to 24/7 operations. Other facilities in K-Area will support final packaging of the down blended containers for the Waste Isolation Pilot Plant characterization/certification and storage of the final waste form until disposal. The FY 2022 request maintains the safe and environmental compliant state of the Savannah River Site excess nuclear facilities including the completion of deactivation activities for Building 235-F and layup activities for the F/H Analytical Laboratory. Completion of these actions will allow reduced surveillance costs as well as the hazards in the facilities.

  The increase over the FY 2021 Enacted level is attributed to an increase in preparation of tanks for waste removal and feed preparation in support of Salt Waste Processing Facility operations at planned rates, an increase in Saltstone Disposal Unit projects due to construction in Saltstone Disposal Units 8 and 9 and Saltstone Disposal Units 10-12, an increase in the preparation of old-style tanks for waste removal and

closure activities supporting feed preparation for Salt Waste Processing Facility and Defense Waste Processing Facility.

- **Office of River Protection**

  The Department is working to complete and operate the treatment facilities to safely immobilize and dispose of tank waste at Hanford. The FY 2022 budget request represents planned efforts for continued progress toward important cleanup required by the Amended Consent Decree and Tri-Party Agreement. The request is designed to maintain safe operations of the tank farms to protect workers, the public, and the environment; meet regulatory commitments; enable the development and maintenance of infrastructure necessary to enable waste treatment operations; and progress single shell tank retrievals. The budget request also supports continued progress toward the completion of the Waste Treatment and Immobilization Plant (WTP) ($666M). Specifically, the request supports completion of the Low-Activity Waste Facilities, Balance of Facilities, and Analytical Laboratory no later than December 2023 and continued design and safety documentation for the High-Level Waste Facility. The mission of the WTP Project is to construct a treatment facility to blend waste from the tank farms with molten glass, which is placed into stainless steel canisters suitable for long-term storage of high-level waste and disposal of low-level waste.

  The decrease from the FY 2021 Enacted level reflects a reduced funding need for the Direct Feed Low Activity Waste portion of WTP.

- **Richland**

  The Richland Operations Office manages all cleanup activities at Hanford not managed by the Office of River Protection, while also providing site-wide services shared by the two offices. Cleanup activities include soil and groundwater remediation, facility decontamination and decommissioning, and disposition of waste other than the tank waste managed by the Office of River Protection. Richland's FY 2022 request continues important cleanup progress required by the Tri-Party Agreement. It will maintain safe operations; perform Hanford site-wide services; support Direct Feed Low-Activity Waste startup and commissioning; and conduct critical site infrastructure projects. The budget request also supports progress in modifications to the Waste Encapsulation and Storage Facility for transfer of the cesium-strontium capsules to dry storage by August 2025, continued groundwater treatment progress, additional progress in the remediation of the 300-296 waste site located beneath the 324 Building, and completion of 105KW Fuel Storage Basin above and below water debris disposition and deactivation activities.

  The increase from the FY 2021 Enacted level allows for the continuation of Richland cleanup progress.

- **Oak Ridge**

  The FY 2022 budget request continues cleanup activities at the Oak Ridge site, including slab and soil remediation at the East Tennessee Technology Park; addressing high-risk excess contaminated facilities at ORNL and Y-12, disposition of U-233 material and transuranic waste; design for the On-Site Waste Disposal Facility to support cleanup of ORNL and Y12; and continued investment in mercury characterization and remediation technologies.

  The decrease from the FY 2021 Enacted level is attributed to planned progress on construction of the Outfall Mercury Treatment Facility and processing transuranic waste, as well as, the ramp down in remaining work to complete the cleanup of the East Tennessee Technology Park.

- **Idaho**

  At the Idaho Site, the FY 2022 funding continues progress in characterizing, packaging, and shipping stored contact-handled and remote-handled transuranic waste. The request also continues processing, characterizing, packaging, and shipping mixed low-level radioactive waste and remote-handled mixed low-level radioactive waste to off-site disposal facilities. The funding request completes treatment of contact handled sludge waste and buried waste exhumations, bringing to a close a decades-long effort to treat legacy waste in Idaho. The Advanced Mixed Waste Treatment Project will continue Resource Conservation and Recovery Act closure activities and transition to demolition and dismantlement efforts.

The decrease from the FY 2021 Enacted level is attributed to the Integrated Waste Treatment Unit transition from completion of facility modifications to startup activities and reflects completion of Idaho Nuclear Technology and Engineering Center infrastructure-related projects to reduce future liabilities. The decrease also reflects a reduction in Radioactive Waste Management Complex infrastructure support as waste processing progresses and facilities transition from Resource Conservation and Recovery Act Closure to demolition and dismantlement.

- **Carlsbad**

  The Carlsbad Field Office is responsible for managing the National Transuranic Waste Program and the Waste Isolation Pilot Plant (WIPP), the Nation's only mined geologic repository for the permanent disposal of defense-generated transuranic waste. The Waste Isolation Pilot Plant FY 2021 request supports disposal facility operations, regulatory and environmental compliance actions, the Central Characterization Project to perform transuranic waste characterization/certification activities to maintain progress toward legacy transuranic waste related milestones at generator sites, transuranic waste transportation capabilities, continued progress on repairing or replacing infrastructure, modernizing underground equipment, and constructing the Safety Significant Confinement Ventilation System (15-D-411) and Utility Shaft (15-D-412).

  The increase from the FY 2021 Enacted level is attributed to continued investments in infrastructure recapitalization projects as well as mine modernization activities. Increase also reflects transportation activities from multiple locations required for sustained operations at a rate of up to 14 shipments per week.

- **Paducah**

  The FY 2022 budget request supports activities to continue environmental remediation and to further stabilize the gaseous diffusion plant. The stabilization activities include non-destructive assay characterization, activities to remove hazardous materials, and surveillance and maintenance. This budget request also supports the safe operation of the Depleted Uranium Hexafluoride Conversion facility.

  The decrease from the FY 2021 Enacted level reflects the completion of activities, including disposition of R-114 refrigerant (Freon), end-of-life replacement of IT equipment, rail and road repairs, and deactivation of the C-531 switchyard.

- **Portsmouth**
  The FY 2022 budget continues decontamination and decommissioning activities. This budget request also supports the safe operation of the Depleted Uranium Hexafluoride Conversion facility. The FY 2022 Budget Request includes funding the On-Site Waste Disposal Facility, Line-Item Capital Project #1 (15-U-408) to receive the debris from the X-326 Process Building at $5,000,000 ($0 for design, $4,750,000 for construction, and $250,000 for other project cost) and includes funding the On-Site Waste Disposal Facility, Line-Item Capital Project #2 (20-U-401) to receive the debris from the X-333 Process Building, at $65,235,000 ($7,500,000 for design, $53,235,000 for construction, and $4,500,000 for other project cost). The mission of these projects is to construct an on-site facility for the disposal of debris generated from the demolition of the Portsmouth Gaseous Diffusion Plant and associated facilities.

  The increase from the FY 2021 Enacted level supports operations and plant and safety reliability modifications, including Integrated Control System for DUF6 operations that replaces the existing, obsolete workstation installed pre-2010. Increase also supports significant progress of pre-demolition activities for X-333 Process Building and continuation of X-326 Process Building demolition, soil excavation, and On-Site Waste Disposal Facility waste placement operations and construction.

- **Los Alamos National Laboratory**

  FY 2022 activities will continue to focus on the removal of legacy waste, soil and groundwater cleanup and protection of surface water at the Los Alamos National Laboratory. The Chromium Plume Control Interim Measure to control migration of a hexavalent chromium plume beneath Mortandad and Sandia Canyons will continue. Additionally, Plume-Center Characterization activities will continue to investigate and develop corrective measures for remediation of the hexavalent chromium plume, and design will be initiated for the

proposed remedies. Investigation and characterization of groundwater for the Royal Demolition Explosives plume in Cañon de Valle will continue. Implementation of the individual storm water permit will continue, and investigation and cleanup of several aggregate areas will be completed. Characterization and cleanup at Technical Area 21 will continue as well as retrieval and repackaging of the below-grade transuranic waste to include readiness activities and infrastructure needs to manage the processing and packaging of the waste at Area G. Remediation activities for Middle DP Road Site based on the FY 2021 investigation of newly discovered legacy contamination will commence. Consistent with the priorities established with the New Mexico Environment Department in the 2016 Consent Order, cleanup activities will continue to focus on groundwater and soil remediation and surface water protection. In addition, the FY 2022 request will initiate planning on deactivation and decommissioning of high-risk excess National Nuclear Security Administration facilities.

The increase from the FY 2021 Enacted level is due to installation of one chromium plume characterization groundwater monitoring wells; acceleration of aggregate area work under the Southern Boundary and Pajarito Watershed Campaigns; vapor monitoring at Material Disposal Areas C and L; Middle DP Road Site remediation and support for the decontamination and decommissioning of high-risk excess nuclear facilities.

($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted	
				$	%
Departmental Administration					
Office of the Secretary	5,119	5,582	5,582	-	0.00%
Congressional & Intergovernmental Affairs	4,395	5,000	6,000	1,000	20.00%
Chief Financial Officer	52,000	53,590	56,591	3,001	5.60%
Economic Impact & Diversity	10,169	10,169	20,000	9,831	96.68%
International Affairs	26,825	26,825	30,500	3,675	13.70%
Artificial Intelligence and Technology Office	2,500	2,500	1,500	-1,000	-40.00%
Chief Information Officer	140,200	140,200	232,258	93,558	65.66%
Subtotal, DA	**241,208**	**243,866**	**352,431**	**108,565**	**44.52%**
Other Departmental Administration					
Management	54,358	54,358	75,358	21,000	38.63%
Project Management Oversight and Assessments	12,596	13,000	13,307	307	2.36%
Chief Human Capital Officer	24,316	24,918	28,250	3,332	13.37%
Office of Small & Disadvantaged Business Utilization	3,337	3,386	3,752	366	10.81%
General Counsel	32,575	35,000	38,000	3,000	8.57%
Office of Policy	7,000	7,000	28,996	21,996	314.23%
Public Affairs	4,000	4,000	5,954	1,954	48.85%
Office of Technology Transitions	14,080	17,639	-	-17,639	-100.00%
Subtotal, Other DA	**152,262**	**159,301**	**193,617**	**34,316**	**21.54%**
Strategic Partnership Projects (SPP**)**	40,000	40,000	40,000	-	0.00%
Total, Departmental Administration (Gross)	**433,470**	**443,167**	**586,048**	**142,881**	**32.24%**
Defense-Related Administrative Support (DRAS)	-179,092	-183,789	-163,710	20,079	-10.93%
Subtotal, Departmental Administration	**254,378**	**259,378**	**422,338**	**162,960**	**62.83%**
Miscellaneous Revenues					
Revenues Associated with SPP	-40,000	-40,000	-40,000	-	0.00%
Other Revenues	-53,378	-53,378	-60,578	-7,200	13.49%
Subtotal, Miscellaneous Revenues	**-93,378**	**-93,378**	**-100,578**	**-7,200**	**7.71%**
Total, Departmental Administration (Net)	**161,000**	**166,000**	**321,760**	**155,760**	**93.83%**

Appropriation Overview

The **Departmental Administration (DA)** appropriation funds 14 management and mission support functional organizations that have enterprise-wide responsibility for administration, accounting, budgeting, contract and project management, human resources management, congressional and intergovernmental liaison, energy policy, information management, life-cycle asset management, legal services, energy jobs, energy justice, workforce diversity, equal employment opportunity, ombudsman services, small business advocacy, sustainability, arctic energy coordination, and public affairs.

The DA appropriation also budgets for Strategic Partnership Projects (SPP) of expenses and offsetting collections and receives Miscellaneous Revenues that offset the costs of the overall program of work. Additionally, the DA program of work operates by executing Defense Related Administrative Support funding appropriated within Other Defense Activities (ODA). This accounts for the support DA programs provide for the Defense portion of DOE.

Program Highlights

In FY 2022, the Office of Technology Transitions is being requested as a separate appropriation. DA program increases are intended to strengthen enterprise-wide management and mission support functions, per the Administration's priorities, as outlined below:

- **Office of the Chief Financial Officer (CFO):** Funding will continue to support OCFO fully staffing to 230 FTEs; funds for corporate business systems to meet and comply with updated cyber security requirements and initiatives; migrate to and operate in a Cloud environment; and enhance systems supporting enterprise business processes and systems, including agency financial report automation and audit management projects. Funding is also requested for continued implementation of the Robotic Process Automation (RPA) initiative across the OCFO activities.

- **Economic Impact & Diversity (ED):** Funding will enable ED to assume the new responsibilities of directly overseeing Employment Equal Opportunities (EEO) complaint processing for the entire DOE enterprise (except for NNSA), as well as directly overseeing the affirmative employment and diversity and inclusion functions for the DOE enterprise (with the exception of the NNSA and the PMAs). ED will also be expanding its mission to include energy justice initiatives across the DOE complex, to include data tracking and trending analyses of DOE efforts in this area. An increase of 32 FTEs is requested to support EEO (consolidation), energy justice, diversity, equity, and inclusion activities.

- **International Affairs (IA):** Funding will support IA's prioritization of initiatives and technical assistance which reflects the changing global energy environment. In FY 2022, IA will continue to pursue international climate and clean energy cooperation through key multilateral and bilateral forums with the objective to reduce global greenhouse gas emissions, create good paying American jobs, enhance U.S. competitiveness, protect those most vulnerable to climate change, and lead a transition to net-zero emissions by 2050. An increase of 10 FTEs reflects current staffing needs.

- **Office of the Chief Information Officer (OCIO):** OCIO's priority is to continue the modernization of DOE's IT infrastructure and IT services to provide the capacity, flexibility, and resiliency required of a modern and secure enterprise. The proposed modernization initiatives will continue to reduce cybersecurity risk through improved cybersecurity technology and automation, scale capacity commensurate with demand, and establish IT enterprise capabilities. Of note, vulnerabilities identified by the SolarWinds intrusion incident of December 2020, will be addressed through funds specifically dedicated to cyber response and recovery management in the FY 2022 Request. These funds, totaling $93,230,000, will be centrally managed by OCIO but used to support the entire DOE complex.

- **Management (MA):** Funding will continue to support up to 206 full time equivalent employees and support MA's mission fulfillment. Funding includes $16 million as part of a transition from GSA-leased gas-powered vehicles to GSA-leased Zero Emission Vehicles. This funding also includes related charging infrastructure and program management costs.

- **Office for Human Capital (HC):** Funding will support current operational levels, maintain HC's vital customer service mission and support ongoing initiatives related to developing more agile, cost-effective operations and a long-term vision for modernizing hiring practices to improve the ability of the DOE workforce to deliver mission outcomes. This will rebuild capacity across DOE and reduce time-to-hire. Funding will also support improvements and enhancements of HR IT systems, including transition to a new hiring management system, USA Staffing.

- **Office of Policy (OP):** Funding increase will support broadening OP's mission to include the Office of Strategic Planning and Policy (OSPP), Office of Energy Jobs, and merging the Arctic Energy Office (AEO) into OP.

($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted	
				$	%
Environment, Health, Safety & Security					
Mission Support	136,839	134,320	132,732	-1,588	-1.2%
Program Direction	71,000	72,000	73,588	+1,588	+2.2%
Total, Environment, Health, Safety & Security	**207,839**	**206,320**	**206,320**	**-**	**+0.0%**

Appropriation Overview

Environment, Health, Safety and Security (EHSS) supports implementing DOE's commitment to maintain a safe and secure work environment for all Federal and contractor employees; ensures operations do not adversely affect the environment, health and safety of surrounding communities; and protects national security and other entrusted assets. EHSS supports achieving DOE's mission in a safe, secure, environmentally responsible manner by providing consistent policy, technical assistance, and corporate leadership for environment, health, safety and security.

Specifically, EHSS maintains policies and guidance that promotes safe, environmentally sustaining work practices in the areas of occupational, facility, nuclear, and radiation safety; environmental protection and quality assurance; supports Departmental and national preparedness and response efforts associated with radiation emergencies and accidents and domestic and international research on exposures of workers and the public to nuclear, radiological, and other hazardous materials; provides health and environmental services to the people of the Marshall Islands; provides medical screenings for former DOE and DOE-related vendor employees; supports the Department of Labor in implementation of the Energy Employee Occupational Illness Compensation Program Act; provides technical security and analytical expertise to develop and assist in the implementation of safeguards and security programs that protect national security assets entrusted to DOE; implements U.S. Government nuclear weapons-related technology classification and declassification program; maintains policies and guidance related to physical protection, personnel and information security and nuclear materials accountability; provides technical assistance to DOE programs, site offices and laboratories to implement cost effective security measures tailored to the mission; maintains corporate security-related information management systems to determine the potential for an undue risk to individual sites, DOE, and national security; and provides for the protection of DOE Headquarters facilities and access authorizations for DOE Headquarters personnel.

Program Highlights

In FY 2022, EHSS proposes to:

- Keep DOE's EHSS policies efficient, effective and in compliance with national policies.
- Support cost effective implementation of EHSS requirements including continued support for implementation of DOE's Design Basis Threat Order.
- Identify and assess effective, safe and reliable physical security technologies to replace failing systems at nuclear facilities and laboratories.

- Continue to improve DOE's safety culture by expanding the safety culture community of interest to share best practices, performing safety culture assessments, and monitoring safety culture performance including analyzing and monitoring results to improve safe accomplishment of work.
- Manage DOE's classification program to protect national security interests and develop advanced computer tools to decrease the cost and increase the accuracy of derivative classifier work throughout the DOE/NNSA complex.
- Manage programs that support EHSS excellence and efficiency across the complex such as the Voluntary Protection Program.
- Manage programs that promote improvements in EHSS knowledge and capabilities such as the Nuclear Safety Research and Development Program and international health studies.

($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted	
				$	%
ARPA-E Projects	390,000	392,000	463,000	+71,000	+18%
Program Direction	35,000	35,000	37,000	+2,000	+6%
Total, Advanced Research Projects Agency - Energy	**425,000**	**427,000**	**500,000**	**+73,000**	**+17%**

Appropriation Overview

The U.S. Department of Energy's Advanced Research Projects Agency-Energy (ARPA-E) was established by the America COMPETES Act of 2007 (Public Law 110–69), as amended. The mission of ARPA-E is to enhance the economic and energy security of the United States through the development of energy technologies that reduce imports of energy from foreign sources; reduce energy-related emissions, including greenhouse gases; improve the energy efficiency of all economic sectors; provide transformative solutions to improve the management, clean-up, and disposal of radioactive waste and spent nuclear fuel; and improve the resilience, reliability, and security of infrastructure to produce, deliver, and store energy. ARPA-E will ensure that the United States maintains a technological lead in developing and deploying advanced energy technologies. ARPA-E will identify and promote revolutionary advances in energy-related applied sciences, translating scientific discoveries and cutting-edge inventions into technological innovations. It will also accelerate transformational technological advances in areas where industry by itself is not likely to invest due to technical and financial uncertainty. The role of ARPA-E is not to duplicate DOE's basic research and applied programs but to focus on novel early-stage energy research and development with technology applications that can be meaningfully advanced with a small investment over a defined period of time.

Program Highlights

ARPA-E has established a nimble, effective management structure and developed a portfolio of technical programs that is delivering innovative, investable opportunities to the commercial sector. ARPA-E will continue to deliver value to the U.S. economy with continued emphasis on maintaining a healthy portfolio of projects. These projects cover a broad range of energy topics, with a growing focus on additional scale-up of the most promising projects that have demonstrated success in technical development, project management, and definition of commercial pathways.

Since its inception in 2009, ARPA-E has provided approximately $2.6 billion in funding to over 1,000 projects through focused programs and Open funding solicitations. 177 ARPA-E projects have attracted more than $4.9 billion in private-sector follow-on funding, 237 project teams have partnered with other agencies for further development, and 88 companies have been formed from ARPA-E projects. In addition, ARPA-E project teams have generated 4,614 peer-reviewed journal articles and received 716 patents from the U.S. Patent and Trademark Office.

In FY 2022, ARPA-E plans to release up to fifteen new funding opportunity announcements (FOAs). The FOAs will address new areas not represented in the present portfolio and develop new opportunities opened by the outcomes of previous programs. The assessment process for the new programs is now underway as described below.

Potential technology areas for up to fifteen focused programs in FY 2022:

- Materials for carbon-neutral or carbon-negative buildings: Novel technologies could enable buildings to be transformed into carbon sinks to reduce their embodied emissions, and potentially make future buildings carbon neutral or even carbon negative. If successful, these technologies would have a significant impact on energy usage and provide a valuable pathway for carbon sequestration. This focus area entails novel materials derived from feedstocks including forestry and other purpose-grown raw materials, agricultural residues, as well as direct use of greenhouse gases (e.g., carbon dioxide, methane). Attaining this vision requires radical new developments in building materials and manufacturing methods. Comprehensive and robust life-cycle analyses and carbon accounting, along with permanency of storage and end-of-life design, will also be necessary.

- Technologies to dramatically reduce high-level nuclear waste: The realization of safe, economical nuclear energy is a critical component for multiple ARPA-E mission areas. Addressing urgent needs for the disposal of existing nuclear waste via novel technologies and processes that eliminate inherent risks, regarding both safety and security, is a key element of this focus. New technologies are required such as modular separations and processing systems which could economically, safely, and securely reduce by an order of magnitude the amount of high-level waste in spent nuclear fuel. Technologies developed in this area may prove beneficial for waste from commercial nuclear reactors, from emerging advanced reactor concepts, or from other sources.

- Advanced battery electrodes and conductors for high capacity and rapid charge: New, disruptive pathways to develop the next generation of batteries are crucial to formulate now to achieve U.S. leadership in this highly competitive area. This focus area seeks to develop battery systems that can withstand extremely fast charging, have a much higher capacity at lower weight, or utilize abundant, easily-sourced materials – all well beyond the capability of current generation Li-ion, or even emerging solid-state Li-metal batteries. Such attributes could enable broad adoption of electrified transportation applications, including electric vehicles and electrified aviation.

- Grid resilience, reliability, and flexibility: The needs for future grid are rapidly evolving with increased levels of renewable power, the proliferation of distributed energy resources (DERs), and the strains and disruptions of extreme weather. These needs are extremely challenging, as the infrastructure for the future grid will still be highly dependent on legacy systems that are decades, or in some cases over a century, old. This presents a tremendous challenge to integrate new technologies within an old system in the face of rapidly changing requirements. In this focus area, ARPA-E is developing technologies that flexibly utilize grid resources – new and old – through approaches in topology and power flow optimization, integration of DERs into transmission-level operations, and microgrids. These approaches may enhance legacy grid operation systems in the near-term, and seek to provide a path to the fully flexible, resilient, and reliable grid system of the future.

- Advanced Fusion Approaches and Energy Applications: Fusion energy is one of a very few potential baseload, low-carbon energy sources that could scale to global proportions. It is an important technology option to develop given this large-scale potential, and if successful, could provide a long-term sustainable energy solution for humanity. Most fusion research today focuses on the Deuterium-Tritium (D-T) thermonuclear reaction, which is the most scientifically mature and accessible path to fusion power, however this is still decades away. There are many other fuel options that, while less scientifically mature than D-T, could offer significant system advantages with far lower levels of neutron production and resultant radiological waste, along with novel power conversion approaches.

- SCALEUP: Expanding the SCALEUP program that was launched in FY 2020 both in scope and funding level to continue the push toward commercialization for previous extremely early-stage ARPA-E programs and to continue the focus on ensuring manufacturing in the U.S.

ARPA-E will also continue its stand-alone SBIR/STTR program to provide additional support to small businesses beyond the significant number of awards to small businesses via ARPA-E's standard non-SBIR/STTR solicitations. ARPA-E plans to release SBIR/STTR funding through its annual Supporting Entrepreneurial Energy Discoveries (SEED) program as well as focused FOAs targeted for SBIR/STTR awards.

($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted	
				$	%
ARPA-C Projects	0	0	180,000	+180,000	N/A
Program Direction	0	0	20,000	+20,000	N/A
Total, Advanced Research Projects Agency - Climate	**0**	**0**	**200,000**	**+200,000**	**N/A**

Appropriation Overview

The U.S. Department of Energy's Advanced Research Projects Agency-Climate (ARPA-C) will invest in climate-related innovations necessary to enable adaptation, increase resilience and achieve net zero non-energy emissions by 2050. ARPA-C's climate mission complements ARPA-E's advanced energy mission but reflects the need to address research activities that encompass more than energy emissions. Appropriations requested here are a down payment on the Administration's broader climate technology agenda that will drive innovation to tackle the climate crisis while creating good paying jobs, assure the United States remains the world's leader in climate technologies, and increase societal resilience to climate change impacts.

ARPA-C's mission will be to harness innovation to solve the global climate crisis while enhancing the economic and energy security of the United States through development of new technologies that will lead to economic opportunities for American workers and businesses. ARPA-C will identify and promote revolutionary advances in climate-related applied sciences, translating scientific discoveries and cutting-edge innovations into products, services, and systems the market, government agencies, and other organizations can adopt. It will also accelerate transformational technological advances in areas where industry by itself is not likely to invest due to technical and financial uncertainty. The role of ARPA-C is not to duplicate the basic research and applied programs within DOE and the other Federal research and development (R&D) enterprises, but to focus on R&D with technology applications that can be meaningfully advanced with a targeted investment over a defined period of time. The Climate Innovation Working Group as part of the National Climate Task Force, co-chaired by the White House Office of Domestic Climate Policy, Office of Science of Technology and Policy, and Office of Management and Budget, will spur initial coordination among climate-related technology agencies. ARPA-C will enable the U.S. to seize a once-in-a-generation opportunity to create and deploy technologies that will transform the U.S. and global economies, and to capture their value for the benefit of the American people.

The Administration has requested funding for ARPA-C in the FY 2022 Budget as well as the American Jobs Plan. The combined $1 billion in the FY 2022 Budget funds ARPA-E, seeds a new ARPA-C, and includes $300 million for other Federal agencies to further fund ARPA-C's mission. The American Jobs Plan includes an additional $15 billion specifically for ARPA-C, an infusion to address the crisis in the near-term with a temporary, but significant effort in supporting novel technology solutions to increase adaptation and resilience as well as creating economic opportunities.

Program Highlights

The FY 2022 budget facilitates the establishment of ARPA-C to identify and promote research with the potential to make revolutionary advances in breakthrough sciences, translate scientific discoveries and cutting-edge inventions into technological innovations, and accelerate transformational technological advances in areas that industry by itself will not support because of technical and financial risk and uncertainty. ARPA-C will support these technologies until they are competitive in the market or at a stage that they can be adopted by government agencies or other organizations that may be the end-users. The $200 million requested will support the buildout of ARPA-C and fund up to six initial programs. While ARPA-C is currently planned to reside within DOE, ARPA-C will have a broad mission and will be a cross-disciplinary effort with an additional $300M requested for the Departments of Agriculture, Commerce, Homeland Security, Housing and Urban Development, Interior, and Transportation, and the Environmental Protection Agency. These interagency ARPA-C partners would coordinate most closely with ARPA-C, making the ARPA-C unique in a mission that spans several agencies rather than ARPA-E or DARPA that primarily serve their Department's. ARPA-C will work with the other Agencies to develop transformative solutions for the climate crisis including adaptation, and resilience, and lay the foundation for future improvements in R&D across the Federal Government.

Potential technology areas for programs in FY 2022:
Initial programming at ARPA-C will focus on creating investments in topical areas of high potential for alleviating the climate crisis that cannot be addressed individually by other Agencies. Programs will be developed in accordance with ARPA-C's program development process; Illustrative examples may include:

- Climate sensors and monitoring for dramatically improved greenhouse gas (GHG) detection, climate analysis, and severe event prediction. Data tools that can assess quantities and permanence of GHGs stored in land, underground, or in oceans, as well as provide relevant regional and local information for adaptation and long-term planning.

- Carbon neutral/negative agricultural production and general land, freshwater, and ocean use (including various carbon sequestration technologies and/or albedo engineering).

- Prevention of GHG emissions from land sources (methane from warming permafrost, landfills, and other activities); new approaches to permafrost protection.

- Carbon neutral waste and recycling, including e-waste processes that concurrently provide critical materials for climate mitigation technologies.

- Resilient infrastructure to protect against climate related severe events, including roads/transit; coastal impacts; building technologies (including reducing heat island impacts), self-healing materials, and air quality systems; water supply and distribution; agriculture and related supply chains.

As the Nation's premier research agency on climate solutions, ARPA-C will serve as a locus of cross-agency research programming and a key implementer of the Administration's Whole-of-Government approach to climate change and innovation. As such ARPA-C may channel funding from other agencies into research activities.

ARPA-C will also create a stand-alone SBIR/STTR program to provide additional support for R&D projects for small businesses.

($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted	
				$	%
Clean Energy Demonstrations					
Program Support	-	-	386,500	+386,500	+100%
Program Direction	-	-	13,500	+13,500	+100%
Total, Clean Energy Demonstrations	**-**	**-**	**400,000**	**+400,000**	**+100%**

Appropriation Overview

The Department of Energy (DOE) proposes to establish the **Clean Energy Demonstrations (OCED)** program for accelerating the maturation of near- and mid-term clean energy technologies and systems with the goal of quicker commercial adoption and increased availability. The OCED will accomplish this through a systematic approach that is informed by, and integrated with, existing clean energy innovation initiatives across DOE's diverse program and functional offices, sites and associated National Laboratories.

The OCED will conduct an annual process of competitive solicitation, selection, negotiation, and award of cost-shared agreements for specific technology demonstrations in partnership with the private sector. The demonstrations will be established as multi-year projects, identifying and incorporating appropriate project management information, including milestones, schedules and cost profiles. The OCED will also conduct administrative steps such as issuing requests for information to obtain technical and programmatic input from industry to help inform the subsequent solicitation, define program parameters, establish merit evaluation boards to review submissions, and conduct the competitive solicitation process.

Program Highlights

- **Program Support**
  Program Support funds a multi-year series of competitive solicitations to conduct demonstrations and envisions to issue at least one technology neutral commercial-scale demonstration solicitation per year focused on a crosscutting energy challenge. The first year solicitation will focus on commercial scale energy storage. In addition, program support will scope crosscutting topics for future solicitations.

- **Program Direction**
  Program Direction (PD) funds the establishment and staffing of this new office. PD will fund the Federal salaries and benefits (including staff training and performance awards), staff travel, associated support services contracts, and administrative expenses to execute the OCED mission.

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted	
				$	%
Energy Information Administration					
National Energy Information System	126,800	126,800	126,800	-	0%
Total, Energy Information Administration	**126,800**	**126,800**	**126,800**	**-**	**0%**

Appropriation Overview

The **U.S. Energy Information Administration (EIA)** is the statistical and analytical agency within the U.S. Department of Energy (DOE). EIA collects, analyzes, and disseminates independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding of energy and its interaction with the economy and the environment. EIA is the nation's premier source of energy information and, by law, its data, analyses, and forecasts are independent of approval by any other officer or employee of the U.S. government.

EIA conducts a wide range of data collection, analysis, forecasting, and dissemination activities to ensure that its customers, including Congress, federal and state governments, the private sector, the public, and the media, have ready access to timely, reliable, and relevant energy information. EIA's data and analysis inform important energy-related decisions, such as the availability of energy sources; government, business, and personal investment decisions; and policy development.

Program Highlights

The FY 2022 Budget Request of $126,800,000 will enable EIA to continue statistical and analysis activities that deliver valuable information to key stakeholders, including:

- The Wee*kly Natural Gas Storage Report* (WNGSR), which is designated as one of the nation's Principal Federal Economic Indicators; and *Weekly Petroleum Status Report* (WPSR), which provides statistics on oil and petroleum product stocks, imports, and production.
- The *Short-Term Energy Outlook* (STEO), which provides monthly forecasts of U.S. and global energy supply, consumption, trade, stocks, and prices projected out 12 to 24 months.
- The *Annual Energy Outlook* (AEO), which projects U.S. energy supply, consumption, trade, and energy-related carbon dioxide emissions over a 30-year period.
- The Energy Consumption and Efficiency Program, including activities to execute EIA surveys of large-scale, multi-year commercial buildings, residential, and manufacturing energy end-use.

The FY 2022 funding will also enable EIA to continue cybersecurity initiatives that will bolster information security across the enterprise.

($ K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs. FY 2021 Enacted	
				$	%
Office of Enterprise Assessments					
Enterprise Assessments	24,068	24,435	27,335	+2,900	+11.8%
Program Direction	54,711	54,635	56,049	+1,414	+2.6%
Total, Office of Enterprise Assessments	**78,779**	**79,070**	**83,384**	**+4,314**	**+5.4%**

Appropriation Overview

The **Office of Enterprise Assessments (EA)** supports the Department's mission priorities and strategic plan for the secure, safe, and efficient operation of the Department's science and energy research, and environmental cleanup activities, and nuclear weapons complex by conducting independent assessments of security and safety performance throughout the Department, taking enforcement action for contractor violations of security and safety regulations, and providing training programs that institutionalize enterprise security and safety lessons learned. EA activities complement, although do not replace, the responsibility of DOE line management for compliance with security and safety requirements to manage the Department's programs effectively.

EA reports directly to the Office of the Secretary and is therefore independent of the DOE programs that develop and implement security and safety policy and programs and therefore is more able to provide objective and timely information to DOE senior leadership, contractor organizations, and other entities on the methods to appropriately protect national security material and information assets; and whether Departmental operations provide for the safety of its employees and the public. EA activities evaluate the Department's effectiveness in promoting protection strategies that are based on informed risk management decisions. EA is designated to implement Congressionally authorized contractor enforcement programs pertaining to classified information security, nuclear safety, and worker safety and health. EA also operates the DOE National Training Center (NTC) in Albuquerque, New Mexico, to enhance the proficiency and competency of the Department's security and safety personnel.

Program Highlights

In FY 2022, EA is strengthening the Department's posture and ability to protect national security assets, its employees, and the public by:

- Conducting comprehensive independent security performance assessments and follow-up assessments at DOE National Security / Category I Special Nuclear Material sites, using limited notice safeguards and security performance tests to provide accurate, up-to-date assessments of DOE site security response capabilities; and evaluating actions to detect insider threats from individuals who may seek to compromise National security and/or the ability of the Department to meet its mission;
- Increasing the number of assessments performed and enhancing the methods and tools used to conduct comprehensive independent cybersecurity assessments, including unannounced red team performance testing, to identify vulnerabilities in the Department's National Security, Intelligence, scientific, and other information systems against external and internal attacks;
- Conducting nuclear safety, worker safety and health, and emergency management independent performance assessments of the Department's operations including high hazard nuclear construction projects and operations such as those at the Los Alamos National Laboratory, Y-12 National Security Complex, Savannah River Site, Hanford Site, and Idaho National Laboratory;

- Enhancing the effectiveness of the DOE enforcement function that holds contractor organizations accountable for noncompliance with worker safety and health, nuclear safety, and classified information security regulations; and
- Providing training programs that promote the competency and proficiency of DOE federal and contractor employees and performing other related functions via the DOE National Training Center in Albuquerque, NM, to institutionalize security and safety data analytics and incorporate safety lessons-learned.

($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted	
				$	%
Legacy Management					
Legacy Management	142,767	142,797	408,797	+266,000	+186%
Program Direction	19,262	20,262	19,933	-329	-2%
Total, Legacy Management	**162,029**	**163,059**	**428,730**	**265,671**	**+163%**

Appropriation Overview

Legacy Management (LM) protects human health and the environment by providing long-term management solutions at over 100 World War II and Cold War era sites where the federal government operated, researched, produced, and tested nuclear weapons and/or conducted scientific and engineering research. Residual hazards remain at these sites after cleanup is completed due to technical limitations of remedial work. As a result, the U.S. Department of Energy (DOE) maintains a post closure obligation to protect human health and the environment after cleanup is completed. LM fulfills DOE's post closure obligation by providing long-term management of sites that do not have continuing missions. The communities where these sites are located have traditionally experienced disproportionately high human health and environmental impacts.

LM appropriations provide funding for Long-Term Surveillance and Maintenance (LTS&M) at 100 or more sites. In addition to this mission, LM evaluates the condition and addresses physical safety hazards at Defense-Related Uranium Mines (DRUM), performs Archiving and Information Management (AIM), assures post-retirement benefits to former contractor workers (Legacy Benefits), conducts Asset Management (AM), Environmental Justice (EJ), Education, Communication, History, and Outreach (ECHO), and Program Direction (PD) functions.

Program Highlights

LM's FY 2022 request is a total increase of $265,671,000 from the FY 2021 enacted level. The increase includes $15,671,000 for LM's core activities supporting historically disadvantaged communities. Additionally, the increase includes $250,000,000 to support the proposal to consolidate the administration of the Formerly Utilized Sites Remedial Action Program (FUSRAP) under a single agency: Department of Energy.

LM's core focus is on its enduring mission to address the Department's environmental, legal, regulatory, and community commitments of the Cold War nuclear legacy. Long-term management of closed sites by LM enables other DOE Programs to focus on risk reduction at contaminated sites and their efficient and effective cleanup. By the end of FY 2022, LM will be responsible for long-term stewardship at 103 sites; including the newly acquired Durita, CO and Spilt Rock, WY Disposal Sites. At these sites, similar to others in LM's portfolio, LM will conduct long-term surveillance and maintenance of environmental remedies (e.g., groundwater monitoring and disposal cell maintenance) to protect human health and the environment; execute the Department's Critical Minerals Leasing Program; perform in-depth studies and implement technological advances to reduce scope and costs; manage an extensive library of physical and electronic records; respond to 1,800 annual requests for information; pursue beneficial reuse and disposal of the Department's properties; and manage pension plan contributions and post-retirement benefits (e.g., medical and life insurance) for 10,000 former contract workers. Additionally, LM will engage in extensive community interaction and outreach to support the long-term stewardship mission as well as the promotion of the Department's Environmental Justice activities.

LM will expand its mission establishing a dedicated DRUM team to provide verification and validation of defense-related uranium mines located on or near Navajo Nation and Tribal lands; as well as execution of major repair projects at LM sites such as the Mexican Hat site in Utah and the Shiprock site in New Mexico.

This request includes a proposal to consolidate the administration of FUSRAP under a single agency: Department of Energy. Upon adoption, the proposal will improve the FUSRAP program by providing consistent funding, expanding its contract capacity, and eliminating administrative layers that could lead to remediation delays. By way of example, during remediation at Shallow Land Disposal Site, the U.S. Army Corps of Engineers (USACE) discovered previously unidentified radioactive material and remediation. The changed site condition required procurement of a new contract with the appropriate expertise. Funding for FUSRAP to a single agency, as proposed here, would have allowed USACE to timely utilize DOE's expertise and contracting capacity. The proposal assigns the administration of FUSRAP to DOE. There would be no change to the execution of the work: USACE will continue to conduct cleanup of FUSRAP sites and LM will continue to conduct LTS&M after cleanup activities are completed. Under this request the total support for the proposal is $250,000,000, equal to FUSRAP's FY 2021 enacted level[1]. Approval of this request facilitates efficient preparation and remediation activities at FUSRAP sites such as the Niagara Falls Storage Site (NFSS) in New York and the Shallow Land Disposal Area (SLDA) in Pennsylvania. Activities at NFSS include contract acquisition for the remedial design at the Interim Waste Containment Site and preparation of the Record of Decision for the Balance of Plant Operable Unit (OU). Activities at SLDA include awarding the task order to remediate two trenches of contaminated materials.

[1] FUSRAP's FY 2021 enacted level appropriated to USACE per P.L. 116-260

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted	
				$	%
Hearings and Appeals					
Program Direction	4,262	4,262	4,356	+94	+2%
Total, Hearings and Appeals	**4,262**	**4,262**	**4,356**	**+94**	**+2%**

Appropriation Overview

Office of Hearings and Appeals (OHA) is the central administrative adjudicatory body for the Department of Energy. OHA's jurisdiction includes conducting evidentiary hearings to determine an employee's eligibility for a security clearance, Freedom of Information Act and Privacy Act appeals, and requests for exception relief from DOE regulations and orders, such as regulatory relief from the appliance energy efficiency standards. OHA also offers alternative dispute resolution services such as mediation for a variety of matters. To reduce travel and other costs, OHA uses video teleconferencing to conduct hearings at DOE field sites.

Program Highlights

Over the last nine years, OHA has reduced its case-processing time in all areas of jurisdiction without compromising the high quality of decisions. The Request supports salaries and benefits for 22 FTEs operating in OHA's Personnel Security and Appeals Division, Employee Protection and Exceptions Division, and the Alternative Dispute Resolution Office.

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted	
				$	%
Office of the Inspector General					
Office of the Inspector General	54,215	57,739	78,000	+20,261	+35.0%
Total, Office of the Inspector General	**54,215**	**57,739**	**78,000**	**+20,261**	**+35.0%**

Appropriation Overview

The **Office of the Inspector General (OIG)** reviews the integrity, economy, and efficiency of DOE programs and operations, including the National Nuclear Security Administration and the Federal Energy Regulatory Commission. The OIG has the authority to inquire into all DOE programs and activities as well as related activities. Audits, inspections, investigations, and other reviews are used to detect and prevent fraud, waste, abuse, and violations of the law.

The Federal Information Security Modernization Act of 2014 directs the OIG to conduct an annual evaluation of DOE's information security systems. The OIG is also charged with reviewing the Department's efforts to eliminate improper payments, in conformance with the Improper Payments Elimination and Recovery Act of 2010. The OIG routinely conducts reviews of the most significant management challenges facing the Department, to include its Environmental Management programs. In addition, the OIG addresses alleged violations of law that impact Department programs, operations, facilities, and personnel.

Program Highlights

The OIG seeks to enhance the efficiency and effectiveness of Department's programs and operations through the following activities:

- **Incurred Cost Audits of Management and Operating Contracts.** Beginning in FY 2022, the OIG will begin conducting, or arranging for, independent incurred cost audits of the Department's Management and Operating Contracts, valued at over $17 billion, as opposed to relying on the Cooperative Audit Strategy through which contractors have been self-auditing. The OIG has budgeted $18.75 million to assume responsibility for the incurred cost audits work.

- **Data Analytics Program.** OIG will continue to expand data collection and analysis efforts by establishing a centralized secure enclave to store and access data. OIG will use the data to identify trends or provide indications of fraud.

- **Office of Investigations.** In recent years, the OIG has experienced a 30 percent increase in the number of criminal investigations and a substantial increase in the dollar value of contractor fraud cases, resulting in additional work by the Office of Investigations. The Tech Operations Directorate is deploying software for enhanced information sharing and collaboration within the department and with other federal agencies. Additionally, the OIG will add a Special Assistant U.S. Attorney position to increase criminal prosecutions.

- **Office of Audits.** OIG performs audits on Department programs and operations, focused on providing reliable and credible financial and performance information. The scope of this work is determined through a risk-based approach focused on areas of greatest risk to the Department.

- **Office of Inspections.** OIG's Inspection team will continue to focus on allegations received from OIG's Hotline, special inquiries raised by Congress or senior departmental officials, and intelligence oversight. It will continue to expand the contractor whistleblower investigative capability.

- **Hotline Allegations.** Changes in the Department's operating environment has resulted in a 35 percent increase to the number of allegations received through the OIG Hotline since FY 2017.

- **Contract Review.** OIG assesses the Department's award and administration of approximately $32 billion in contracts. In FY 2020, OIG work resulted in sizeable settlements by subcontractors.

- **Cybersecurity Oversight Efforts.** OIG conducts oversight in this area and frequently partners with other agencies to address attacks affecting DOE.

- **NNSA Modernization Efforts.** NNSA has undertaken a modernization effort that involves major projects (e.g., weapons complex transformation). OIG will conduct reviews that will proactively seek to identify opportunities to improve the efficiency and effectiveness of these operations.

- **Environmental Management.** The Department's environmental liability of $512 billion remained on the Government Accountability Office's Biennial High Risk List in 2021. The OIG routinely reviews the efficacy of the Department's environmental programs.

- **Mission Support Costs.** OIG assists in identifying potential costs savings in areas such as the estimated $5.9 billion spent each year on National Laboratory support costs.

- **New Offices/Classified Space.** OIG will continue its efforts to open offices in strategic locations and acquire a sensitive compartmented information facility.

($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted	
				$	%
Federal Energy Regulatory Commission (FERC)					
Just and Reasonable Rates, Terms and Conditions	176,468	182,261	213,353	+31,092	17.1%
Safe, Reliable, and Secure Infrastructure	132,286	142,757	160,169	+17,412	12.2%
Mission Support through Organizational Excellence	73,246	79,332	90,378	+11,046	13.9%
FERC Revenues	-382,000	-404,350	-463,900	-59,550	-14.7%
Subtotal, Federal Energy Regulatory Commission	**0**	**0**	**0**	**0**	**N/A**
Fees and Recoveries in Exess of Annual Appropriations	-16,000	-9,000	-9,000	0	0.0%
Total, Federal Enegry Regulatory Commission	**-16,000**	**-9,000**	**-9,000**	**0**	**0.0%**

Appropriation Overview

The **Federal Energy Regulatory Commission (FERC or the Commission)** is an independent agency within the Department of Energy (DOE) that regulates the transmission and wholesale sale of electricity and natural gas in interstate commerce, as well as the transportation of oil by pipelines in interstate commerce. FERC also reviews proposals to build interstate natural gas pipelines, natural gas storage projects, and liquefied natural gas (LNG) terminals, and licenses and inspects non-Federal hydropower projects. The Commission protects the reliability and cybersecurity of the Nation's bulk-power system through the establishment and enforcement of mandatory reliability standards and oversees environmental matters related to natural gas pipeline and non-Federal hydro projects. The Commission enforces its regulatory requirements through the imposition of civil penalties and other means.

FERC's mission is to assist consumers in obtaining economically efficient, safe, reliable, and secure energy services at a reasonable cost through appropriate regulatory and market means, and collaborative efforts. FERC seeks to ensure that rates, terms, and conditions of jurisdictional service are just, reasonable, and not unduly discriminatory or preferential, relying on competitive markets where appropriate. Through its oversight and enforcement authorities, FERC seeks to increase compliance with its rules and regulations and detect and deter market manipulation. FERC's responsibilities also include promoting the development of safe, reliable, and secure energy infrastructure that serves the public interest. FERC recently established a new senior counsel position to lead its consideration of environmental justice in the context of these responsibilities, building on FERC's prior consideration of environmental justice in its energy infrastructure proceedings.

Program Highlights

- **Ensure Just and Reasonable Rates, Terms, and Conditions**

  One of the Commission's fundamental statutory responsibilities is to ensure that rates, terms and conditions for wholesale sales and transmission of electric energy and natural gas in interstate commerce, as well as for transportation of oil by pipeline in interstate commerce, are just and reasonable and not unduly discriminatory or preferential. To fulfill this responsibility, the Commission uses a combination of market and regulatory means, complemented by oversight and enforcement measures. The Commission carries out this responsibility by issuing orders and establishing rules and policies that continually balance two important interests: protecting consumers against excessive rates, and providing an opportunity for regulated entities to recover their costs and earn a reasonable return on their investments. For example, the Commission seeks to improve the competitiveness of organized wholesale electric markets, which in turn encourages entry of new resources, spurs innovation and deployment of new technologies, improves operating performance, and exerts downward pressure on costs. Another example of the Commission's use of market and regulatory means in support of this goal is found in the Commission's requirements for public utility transmission providers to participate in an open and transparent regional transmission planning process. In addition, the Commission approves cost-based, and where appropriate, market-based rates for the interstate transportation of natural gas and oil on jurisdictional pipelines, and for the interstate transmission, and wholesale sales of electric energy. The Commission also reviews proposed mergers and other transactions in the electric industry to ensure that these proposals will not harm the public interest.

  Oversight, surveillance and enforcement are essential complements to the Commission's approach to ensure that rates, terms, and conditions of service are just and reasonable and not unduly discriminatory or preferential. The Commission conducts compliance audits, issues publicly available audit reports, and engages in formal and informal

outreach efforts to promote effective compliance programs. Audits are planned and prioritized using a risk-based approach in order to maximize the impact of the Commission's resources. The Commission also conducts public and non-public investigations of possible violations of the statutes, regulations, rules, orders, and tariffs administered by the Commission. These investigations often rely upon oversight and surveillance that employ sophisticated technology to monitor market behavior. When violations of sufficient seriousness are discovered, the Commission attempts to resolve the resulting investigation through settlement with appropriate sanctions and future compliance improvements before initiating further enforcement proceedings.

- **Promote Safe, Reliable, and Secure Infrastructure**
  The Commission plays an important role in the development of energy infrastructure that operates safely and reliably. One aspect of the Commission's role in energy infrastructure development stems from siting authority that includes licensing non-federal hydropower projects, certificating interstate natural gas pipelines and storage projects, authorizing liquefied natural gas (LNG) facilities, and, in certain circumstances, permitting electric transmission lines. The Commission reviews applications to construct, operate, or modify natural gas and hydropower infrastructure by ensuring that facilities are constructed and operated in compliance with the conditions of FERC orders. The Commission must respond to energy infrastructure applications with timely and well-reasoned decisions that balance a range of factors such as competing interests, legal requirements, and environmental impacts. The Commission encourages, and sometimes requires, project proponents to engage in early involvement with state and federal agencies, Indian tribes, affected landowners and the public. The Commission's request provides continued funding for program contracts associated with statutorily required workload associated with hydropower and natural gas infrastructure, including environmental reviews, stakeholder engagement, and construction oversight.

  The Commission also has an important role in ensuring that energy infrastructure, once authorized, continues to operate safely and reliably. FERC conducts timely safety reviews and inspections with rigorous requirements, thereby advancing the safety of non-federal hydropower projects and LNG facilities throughout their entire life cycle. The Commission relies on physical inspections for detecting and preventing potential catastrophic structural failures. In regards to jurisdictional LNG facilities, the Commission conducts construction and operational inspections to ensure that the facilities are constructed and operated in accordance with the conditions of Commission Orders, including safety measures and plans. Inspections at both types of facilities protect the public against the risks associated with incidents at the facilities.

  The Commission also oversees the development and review of mandatory reliability and security standards for the bulk-power system, as well as compliance with these standards. FERC promotes the reliable operation of the bulk-power system through oversight of the electric reliability organization (ERO). A Commission-certified ERO develops and enforces mandatory Reliability Standards, subject to the Commission's oversight and approval. The Reliability Standards address the planning and operation, as well as the cyber security and physical protection of the Nation's electric transmission grid. The Commission may also, upon its own motion or upon complaint, order the ERO to submit a proposed reliability standard or a modification of an existing reliability standard that addresses a specific reliability matter. To that end, the Commission incorporates performance data-driven, risk-informed decision making into its reliability oversight. In addition, FERC provides leadership, expertise, and assistance in identifying, communicating and developing solutions to cyber and physical security risks to FERC-jurisdictional infrastructure. This is achieved through collaboration with federal and jurisdictional entities to identify, inform, assess, and address cyber and physical security threats and vulnerabilities, and to promote voluntary best practices that provide an important complement to FERC's related responsibilities for both regulatory requirements and enforcement. The Commission engages with the owners and operators of key critical infrastructure facilities to identify and share threat information, analyze system vulnerabilities, and assist with effective mitigation.

- **Mission Support Through Organizational Excellence**
  The public interest is best served when the Commission operates in an efficient, responsive and transparent manner. The Commission pursues this goal by maintaining processes and providing services in accordance with governing statutes, authoritative guidance, and prevailing best practices. These processes and services help prioritize resource allocations, make prudent investments that yield returns that directly benefit the agency's mission and use Commission resources in an efficient manner. The Commission also provides services, tools, and resources to equip employees to drive success and accomplish the agency's mission. The Commission thus makes continued investments in its human capital, information technology (IT)

resources, and physical infrastructure. The Commission allocates sixty-two percent of its budget to directly cover the compensation costs of its employees on an annual basis. The Commission continues to focus its human capital efforts on the competencies and positions most affected by the challenges of new and emerging knowledge/skill demands and the loss of institutional knowledge. The Commission's overall IT infrastructure must meet the demands and keep pace with the continual changes in the technology landscape; proactivity monitor and mitigate emerging cybersecurity threats; and adhere to federal requirements. In FY 2022, the Commission will make additional investments to continue its multi-year effort to update and modernize the Commission's information technology infrastructure and core mission and support systems to maintain a secure and reliable IT infrastructure to meet the needs of the Commission and provide innovative solutions to support employees. The Commission is also undergoing a multi-year renovation effort within its headquarters building. As a result of these modernization efforts, the Commission will consolidate all National Capital Region lease locations into the headquarters building and reduce its real estate footprint by approximately 123,000 square feet. At the current market rate, the reduction in space would result in estimated annual rent savings of approximately $6.4 million. The FY 2022 request includes approximately $11.9 million to cover construction costs to continue the modernization effort.

Facilitating understanding of how the Commission carries out its responsibilities and maintaining public trust in the Commission are important components of the Commission's commitment to organizational excellence. Trust and understanding increase acceptance of Commission decisions. The Commission achieves this by maintaining processes and public information services that promote transparency and open communication with respect to the conduct of the Commission's business. FERC's proactive communication, along with an online document repository and timely responses to inquiries, fosters awareness and understanding of the Commission's activities. The Commission also manages several social media sites to promote transparency and open communication.